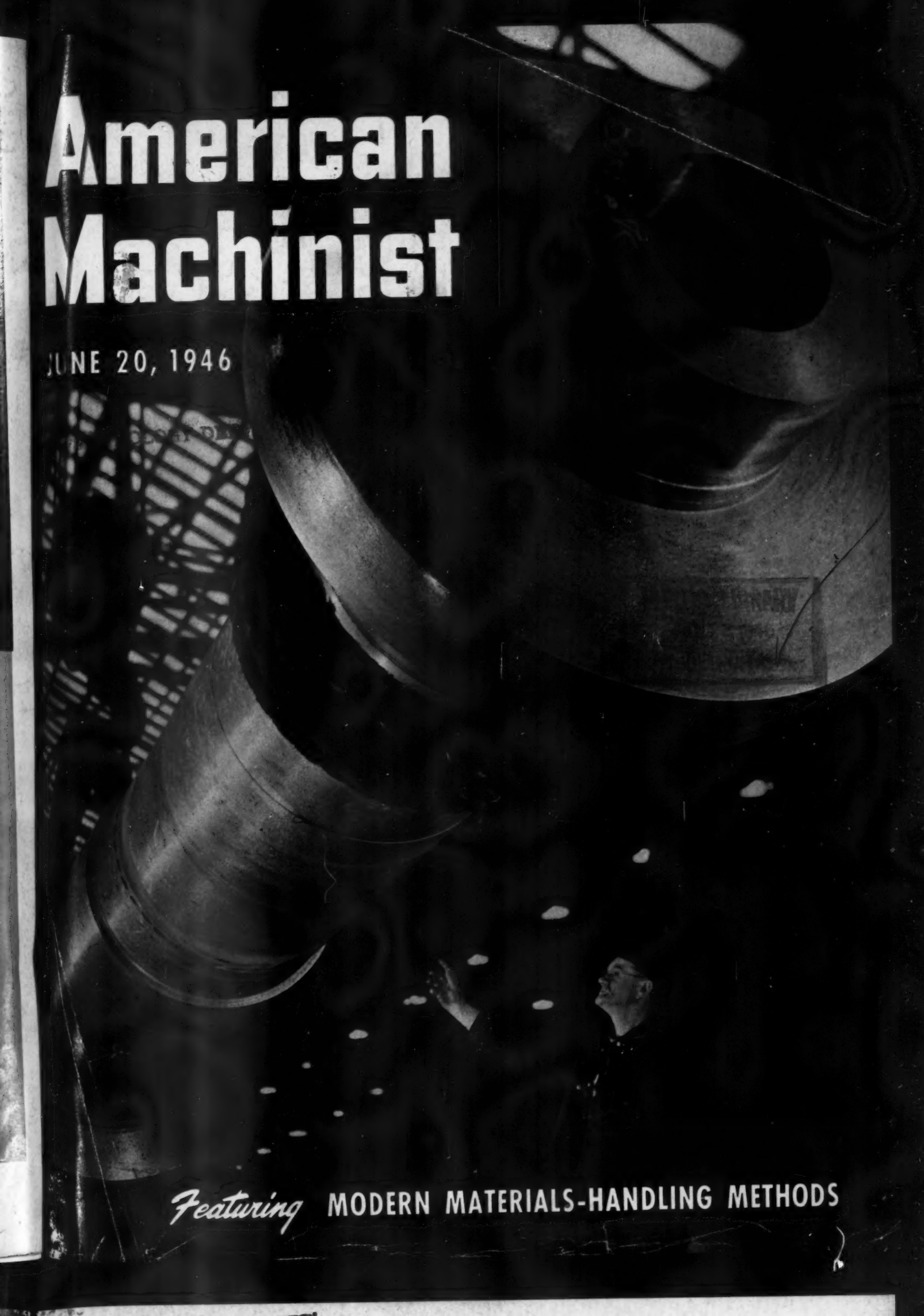
American Machinist

JUNE 20, 1946



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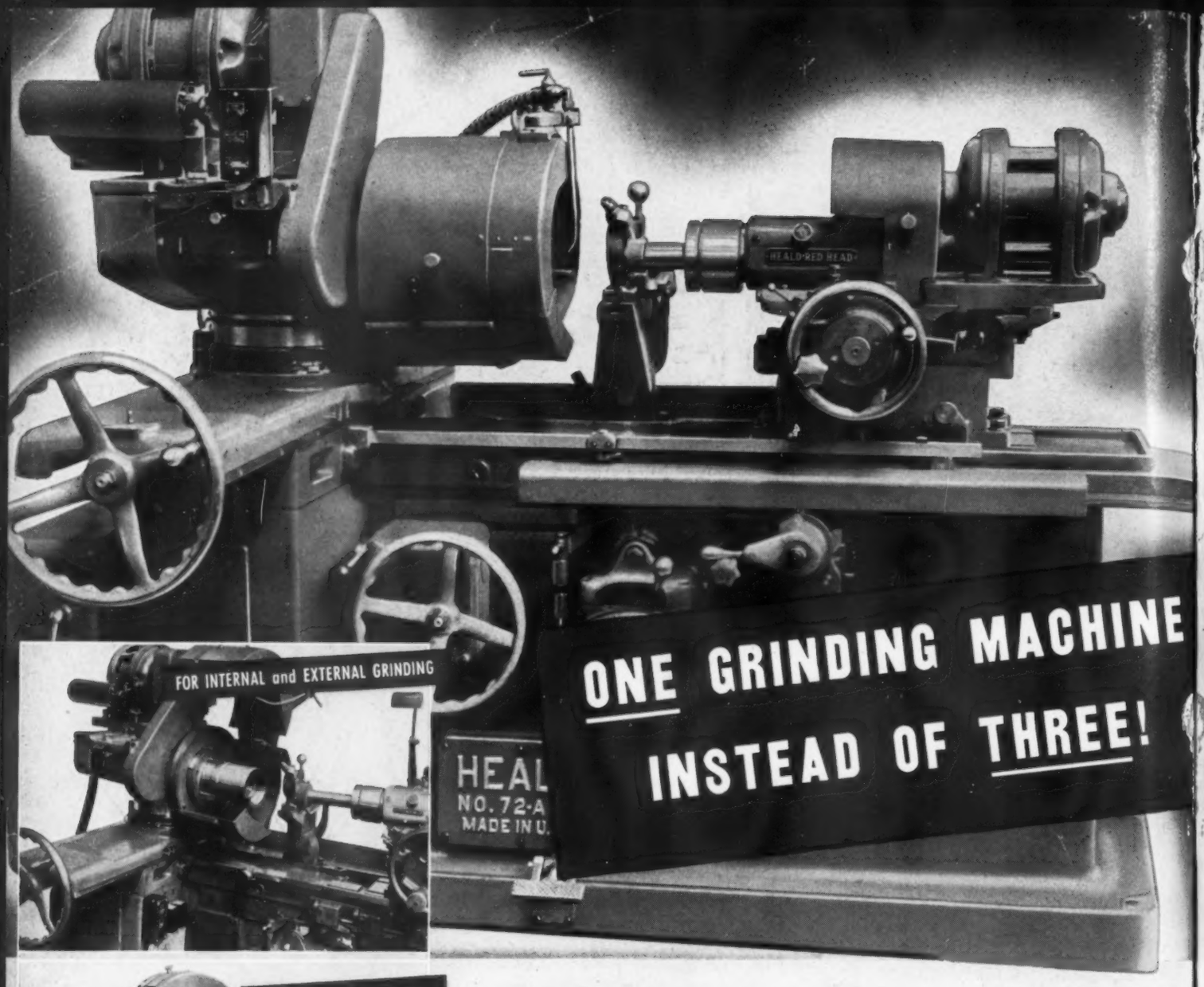

Handle all your small lot grinding jobs on the Heald Plain Universal—and bring your costs down!

It's the small-lot grinding jobs that are costing you money these days—with their expensive manual operations and time-wasting setups. And that's just where the Heald 72-A Plain Universal pays off handsomely, by doing the work of *three* machines—the internal, the external, and the surface grinding machine.

Think of the big savings you can realize when you have one machine putting forth the tooling effort of three—*direct* savings from lower equipment costs, from reduced maintenance, from smaller floor space and fewer man hours—savings that may well make the difference between profit and loss on your small-lot orders.

Such savings stem from the ability of every Heald precision grinding or bori machine to turn out a better quality pro uct . . . at less cost to you. Whether y handle small shop work or mass produ tion jobs, experienced engineers fr Heald's staff of 200 can show you how best equip your plant for greater produ tion . . . at lower unit costs. For furth information, write: THE HEALD MACHIN COMPANY, Worcester 6, Mass.

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means more precision . . . less cost

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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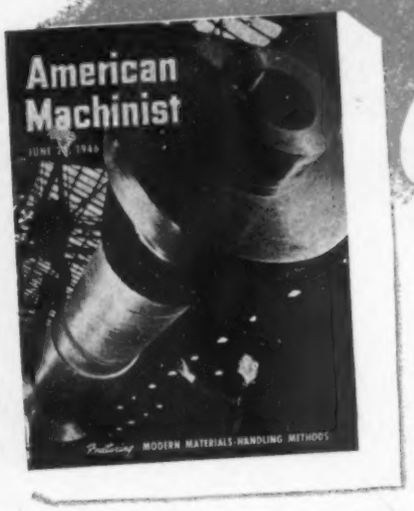


Chips and QUIPS

Heavy, heavy . . . Our cover Kodachrome shows an overhead crane in the Allis-Chalmers shops suspending a 17½-ft. shaft fashioned from a 200,000-lb. ingot for the fifth TVA Kentucky Dam hydraulic turbine. The shaft, which has 60-in. flanges at each end, weighed 74,000 lb. after rough-turning and 62,000 lb. after boring. The crane hitcher is Rudolph Mueller.

Compression Job . . . Few executives realize how much handling is involved in metalworking operations. Materials are heavy, bulky, fragile or small—any of these conditions offering chances for mill losses, in initial handling, in moving between machines or operations, in feeding and ejecting. There is little doubt that handling is a major factor in costs.

That's why we've chosen materials handling as the subject for our most comprehensive special report thus far. Elements have been collected over the past four years. Fundamentals are shoehorned into 32 pages you'll want to study and keep. Associate Editor Harry Wharen has combed data from a couple of hundred makers and users of materials-handling, checked the manuscript with half a dozen experts who were sure at least a book would be required, now are itchy-fingered waiting for this issue.

Educated Paint . . . Spray guns deliver paint uniformly over an area. If the area was half object and half holes, half the paint missed the target. But no more. Now an electrostatic field pushes paint particles onto the piece, smoothes film, avoids teardrops. Better read about it—right after the special section . . . Schlarman, Wildhaber and Haydock continue their series. . . . And, despite that tremendous special section, all departments are in his issue, although we had to squeeze a dozen extra pages out of our limited paper supplies to do it.

Coming . . . For Independence Day, we'll have an issue packed with short but potent subjects. Leading the editorial content is the first half of a 2-part report of McKinnon Industries' experience with negative-rake carbide tools cutting tough alloy steels at high surface speeds . . . Other machine-tool articles include Joshua Hendey's method of using setup plates to reduce boring-mill waiting time, some hints by Melnitzky on effective use of power saws, a description of the latest in one-company-furnished multi-machine production lines, and more on thread cutting with dieheads.

For Planners . . . There's something for everybody in July 4 *A.M.* An experienced shopman picks holes in time-study procedures, another champions and explains "process engineering" . . . Safety men can use the poem about three blind mice, can get ideas for reducing dust troubles in machining . . . A spread of Shop Shots from the Erie will give railroad master mechanics—and many others—ideas . . . There's more on electronics, a Round Table, a special report on profit sharing—and for everybody our popular departments.

"Can You Tell Me" . . . Our editors have many requests for information from readers, some requiring considerable head-scratching to answer. Others are so unusual you wonder why they were asked. In the latter class are those from a G. I. for an explanation of mass-production methods on ping-pong rackets, another on rubber Easter bunnies complete with squeak. A radio maker wants a "baby" planer to go on a bench, two fellows ask for dope on stoneworking lathes and saws. An editor soon gets to be a jack of all trades—if he doesn't start out that way.

Old Timer . . . C. W. Hinman, whose name will be familiar to many long-term readers as the author of scores of *A. M.* articles during the last 40 years, writes a short on drawing even-topped shells in the *Practical Ideas* section of this issue. He is almost our oldest, and probably our most prolific, contributor. Hundreds of his articles on machine design, tools and dies have appeared.

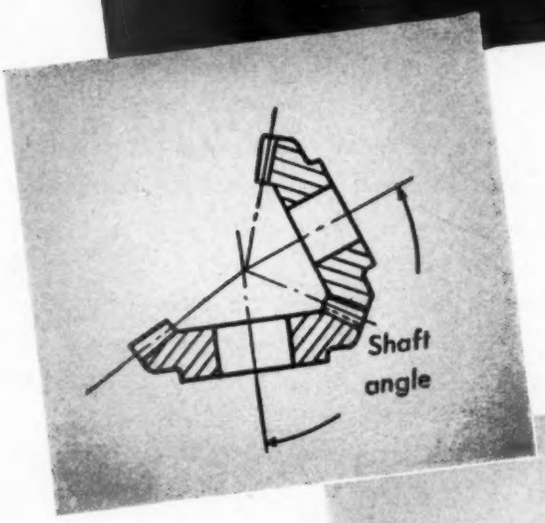
His first book, "Practical Designs for Drilling and Milling Tools," first published in 1938, was based on an *A. M.* series. His second, "Pressworking of Metals," was also. His third, "Die Engineering Layouts and Formulas," was published in 1943. Total circulation to date, 35,000 copies.

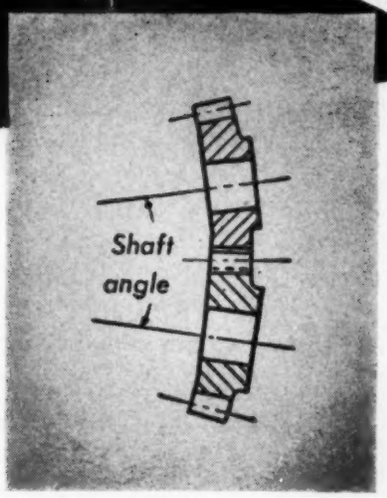
Mr. Hinman's practical training began 56 years ago, when he sawed blocks from palmetto roots in a St. Augustine (Fla.) brush factory. He sharpened his own saws with a round-nosed thin emery wheel, tilting the saw to grind the kerf. Guards and goggles were *not* used. In his spare time, he supervised several colored men who chopped tough scale off the roots. That brush factory was still standing—but vacant—in 1941.

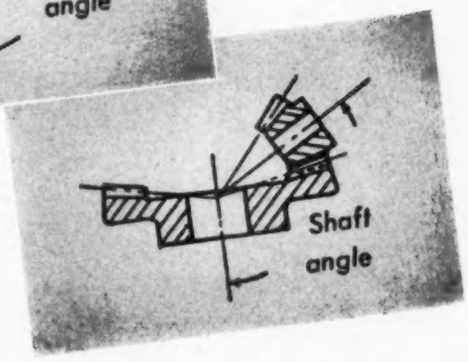
Mr. Hinman attended Iowa State and Armour Institute, then went to Rock Island Arsenal where he drafted test tools, gages, and parts of the 3.2-in. field gun—our only ordnance contribution to World War I. He was chief tool engineer (jigs and fixtures) at Western Electric (8 yr.) and Automatic Electric (10 yr.), Chicago, tool engineer at Addressograph, Remington Typewriter, Budd, Scripto and Kobzy (chief at the last for 10 yr.). Now he splits his year between Miss. and Ind., confesses to the same age and state as Hawkeye Herbert Hoover.

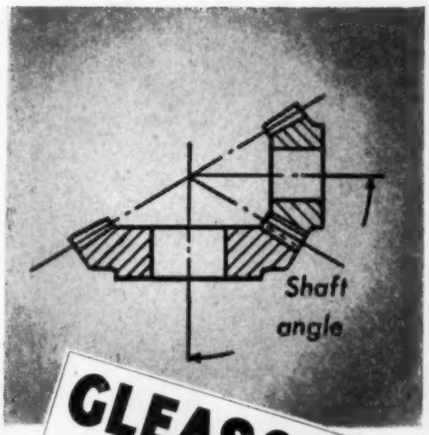
FOR ANY ANGLE USE BEVEL GEARS

PROVEN... in the field of power transmission ... by durable unfailing performance ... with light or heavy loads at every possible speed ... bevel gears are the most satisfactory means of making "power turn a corner." Innumerable smooth-operating angular drives in daily use have shown this to be true. Sketched below are just four examples of the wide range of shaft angles possible when using bevel gears.









It is important to select the proper type of bevel gear for the particular application and angle involved. Send us blueprints of your proposed bevel gear designs ... our engineers will study them ... suggest improvements ... and recommend the correct gear cutting machines to meet your specific manufacturing requirements.

GLEASON Works
Builders of BEVEL GEAR MACHINERY FOR OVER EIGHTY YEARS

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ROCHESTER 3, N. Y., U. S. A.

Presenting THE CINCINNATI MONOSET CUTTER AND TOOL GRINDER

This versatile cutter and tool grinder not only sharpens cutters, it grinds them from the solid, quickly preparing special cutters when needed. ¶ The CINCINNATI Monoset is so flexible that all operations necessary in the grinding or making of many types of cutters can usually be accomplished with one chucking of the workpiece. Thus you are assured of excellent concentricity; all teeth are exactly alike and will carry an equal share of the cutting load. Here are some of the features that make the CINCINNATI Monoset extremely versatile and flexible: a) Infinitely variable spiral leads. b) Workhead swivel mount for generating accurate radii. c) Micrometer dials and stops for all slides. d) Simple, accurate indexing devices. e) Wheelhead adjustable in three planes f) Workhead motor drive for cylindrical grinding Further details about these features, together with engineering specifications, may be obtained by writing for catalog M-1386-1

Examples of cutters which are easily ground on the CINCINNATI Monoset Cutter and Tool Grinder — many of them from the solid, and at one chucking of the workpiece

THE CINCINNATI

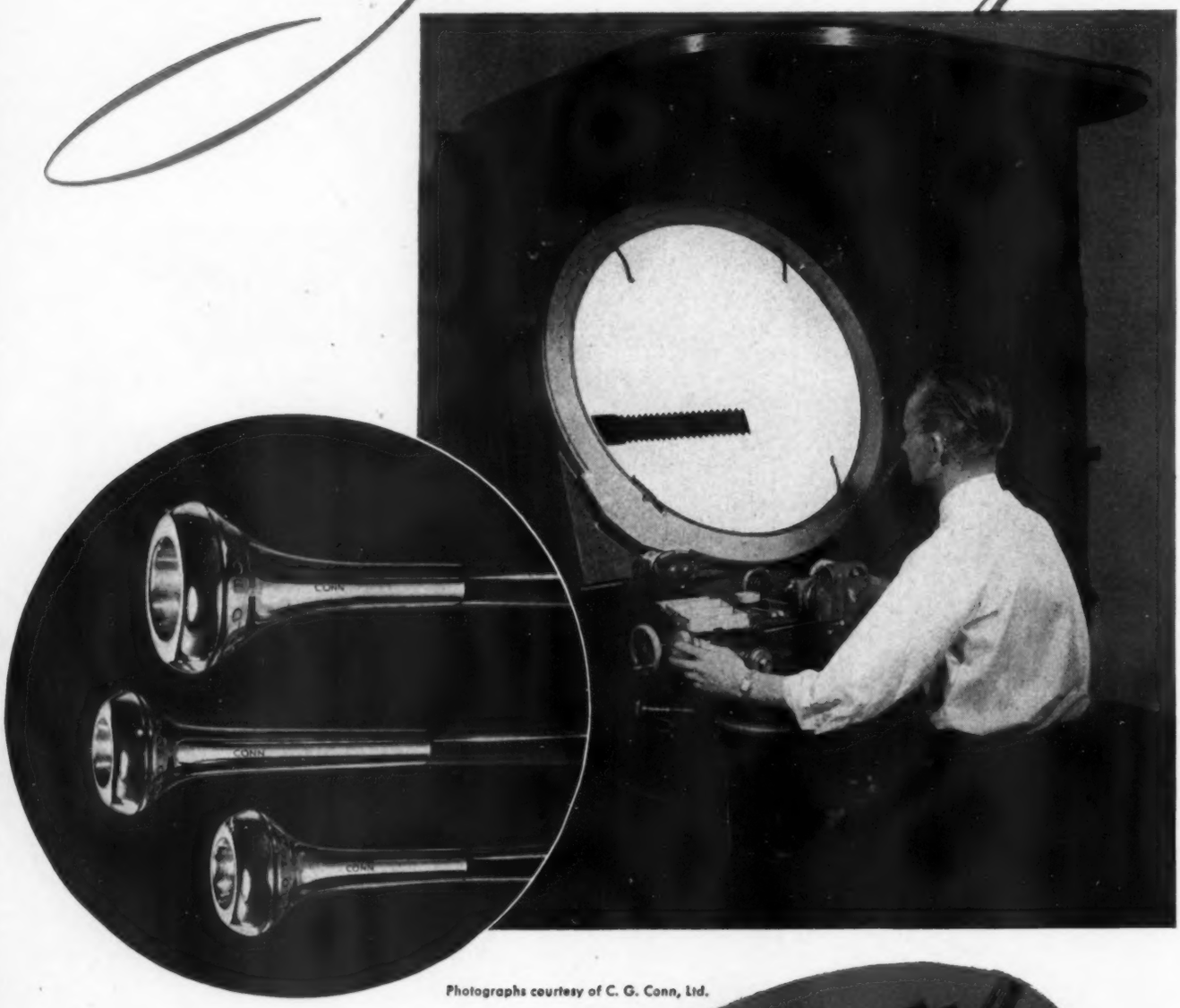
MILLING MACHINES

CINCINNATI Monoset Cutter and Tool Grinder. Catalog M-1386-1 contains complete specifications. Write for your copy today. A brief description of this machine is carried in Sweet's Catalog File for Mechanical Industries.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

Scarcely



Photographs courtesy of C. G. Conn, Ltd.

Beyond a SHADOW of a doubt

Perhaps a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.

DID YOU KNOW...
THAT JONES & LAMSON COMPARATORS ARE USED TO CONTROL THE EXCEPTIONALLY CLOSE DIMENSIONAL TOLERANCES OF THE NEW BALL POINT TYPE PENS?

THICKER THAN A *Hair!*

Small screws and threaded rods scarcely thicker than a hair, small musical instrument parts and peculiarly shaped tools that form the curves of cup mouthpieces are inspected on Jones & Lamson Optical Comparators.

This method of inspection enables the manufacturer to control the precision and high quality of these musical instruments at the source—rapidly and economically.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

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MACHINE COMPANY
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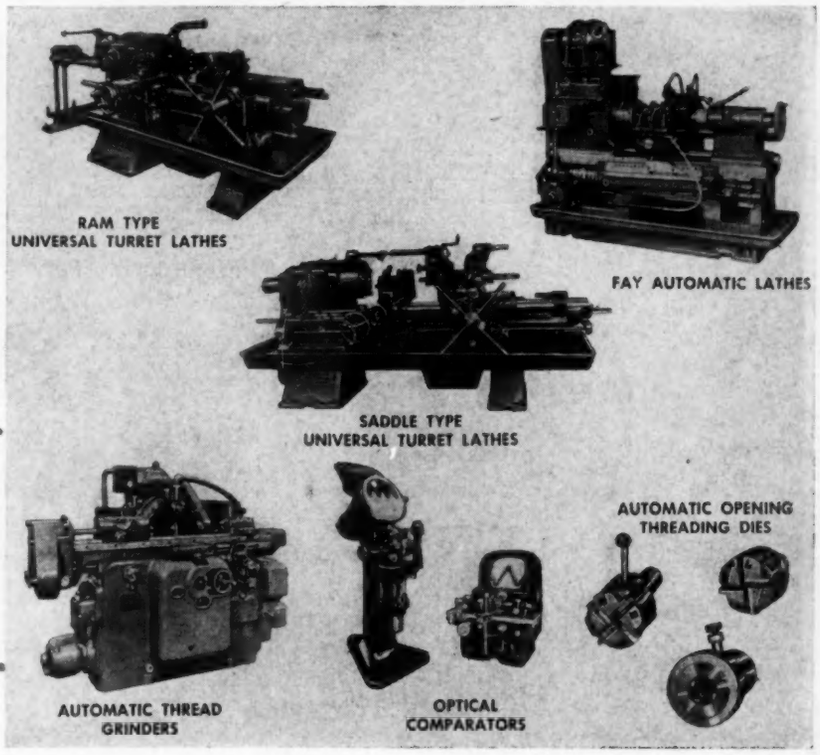
Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.



Clearance..... .001"

THE FELLOWS METHOD...MACHINES AND TOOLS FOR

to .0015"

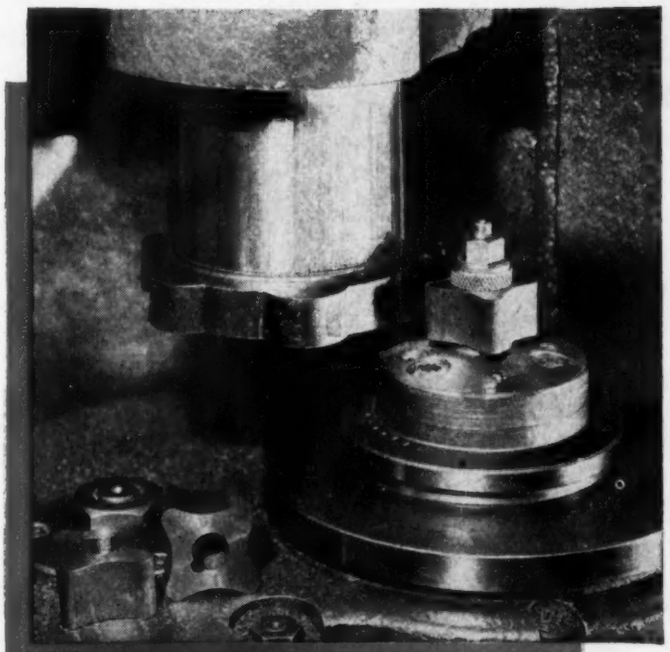
definitely maintained on the GEAR SHAPER

AUTOMOTIVE PUMP ROTOR A TYPICAL HIGH-PRECISION JOB

It is a real problem to produce the inner member of this Pump Rotor within the tolerances imposed. It must rotate freely in the mating outer member, yet with such close clearance as to permit pumping oil at pressures up to 100 p.s.i.

Material is a special grade of cast iron having good wearing qualities. Critical considerations are that the contours shall be exactly conjugate to the mating member, and within extremely close dimensional limits.

The job is "a natural" for the 7-Type Gear Shaper. Work is held in a special fixture, and a special cutter provided. The cutting time is 1¼ minutes, one piece being cut at a setting. The inherent precision of the machine and cutter holds accuracy under positive control.

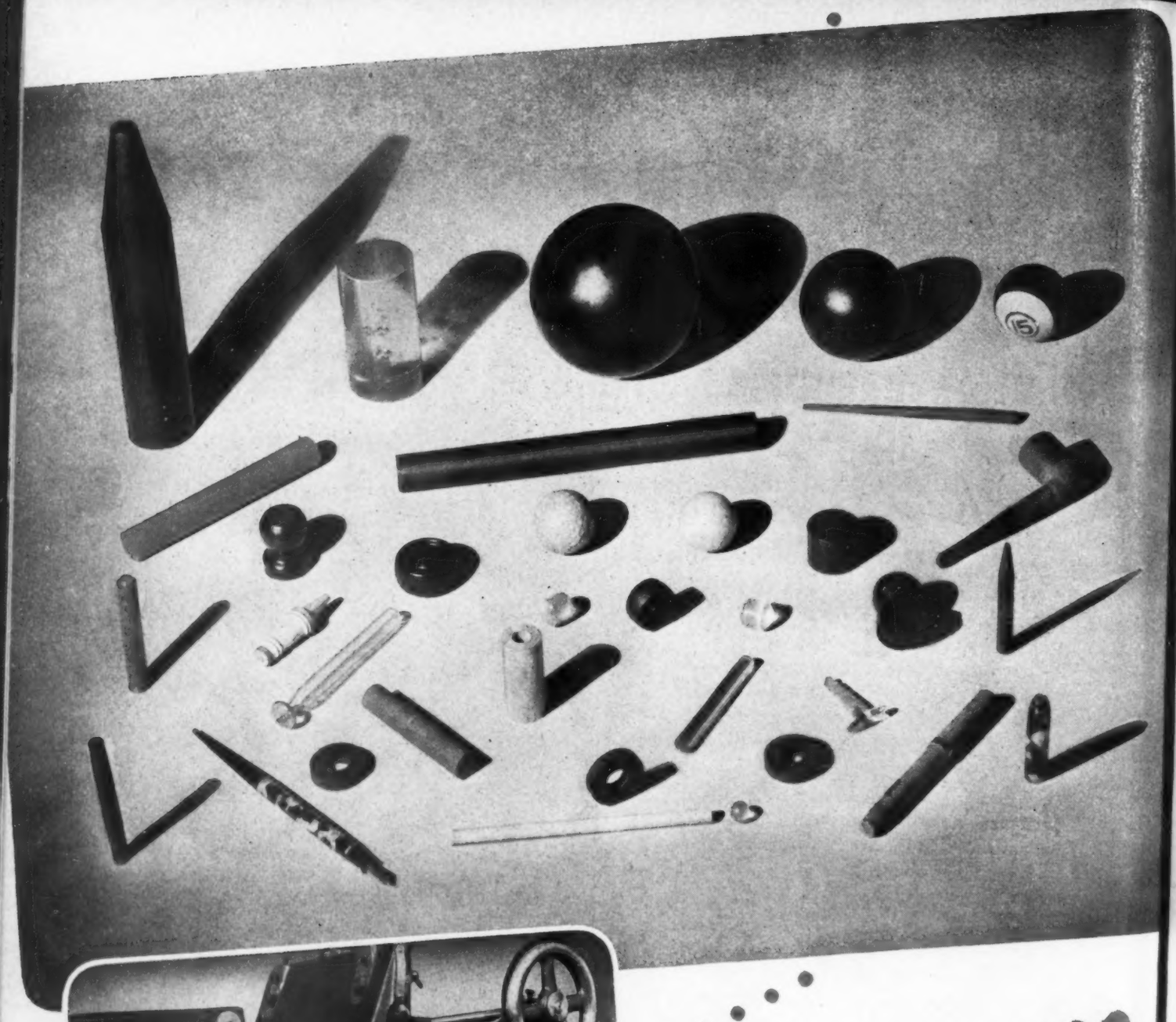


A close-up of the cutting operation on the 7-Type Fellows Gear Shaper

For a study of similar examples of Gear Shaper precision and versatility see "The Fellows Method". Write for a copy, to The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit—or 640 West Town Office Building, Chicago.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR



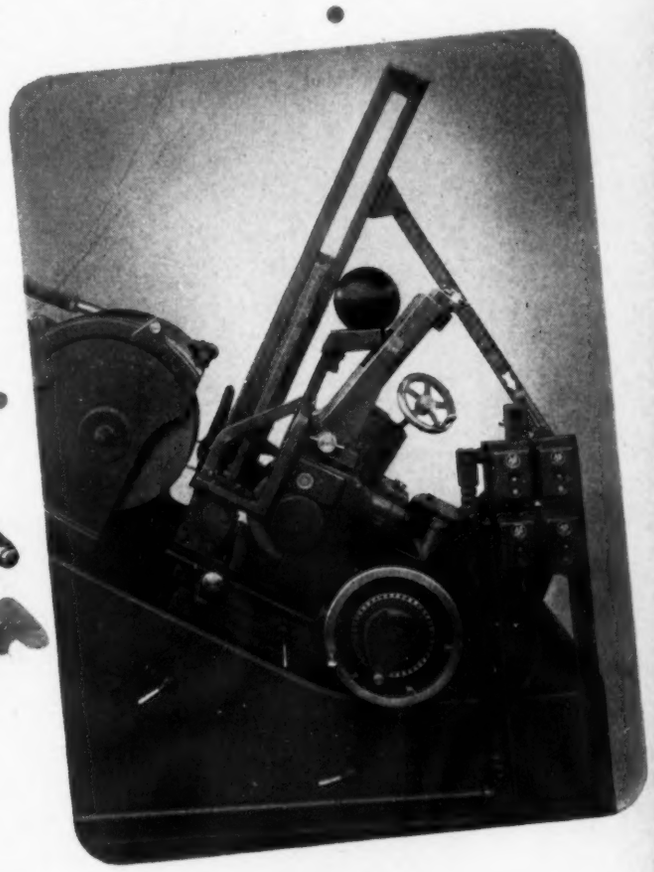
Grinding end of fragile glass condenser. Production per pass per hour, 416. The machine is a CINCINNATI No. 2 Centerless with special work rest and a rotating device to reduce breakage.

from GLASS to

CINCINNATI

CENTER TYPE GRINDING MACHINES

Those interesting parts and products in the photograph at the left have all been ground on CINCINNATI Centerless Grinders. They illustrate the almost limitless possibilities of these machines for quick, accurate finishing of nonmetallic parts. There are golf, pool, duck pin and bowling balls, spark plug cores, fountain pen barrels and caps, bottle stoppers, carbon electrodes, rubber washers, plastic casters, wood rolls, glass and plastic cylinders and tubing, a pipe on which the stem is ground. And by applying special techniques, the centerless method greatly reduces breakage during grinding operations on fragile parts. ¶ Cincinnati Engineers are adding constantly to the centerless applications they have developed. Talk over with them all your finishing operations. Or better still, send us your blueprints and complete details of parts so our engineers can study your requirements and recommend the correct machines and methods for lowest cost production. ¶ CINCINNATI Centerless Grinding Machines are available in three standard sizes, Nos. 2, 3 and 4. Complete engineering specifications may be obtained by writing for catalog G-456-3 for the No. 2 machine, G-438-3 for the No. 3, G-538 for the No 4. Larger and smaller machines are available for special applications.

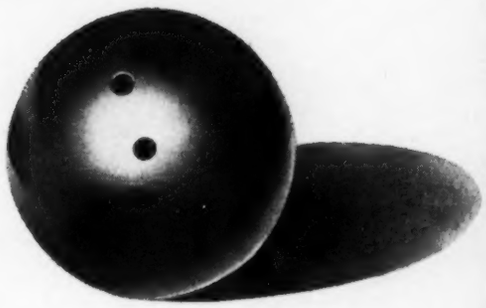


Grinding bowling balls by the centerless method. Net production is almost 17 per hour. The machine is a CINCINNATI No 4 Centerless Grinder.

BOTTLE STOPPERS

CINCINNATI

BOWLING BALLS



GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

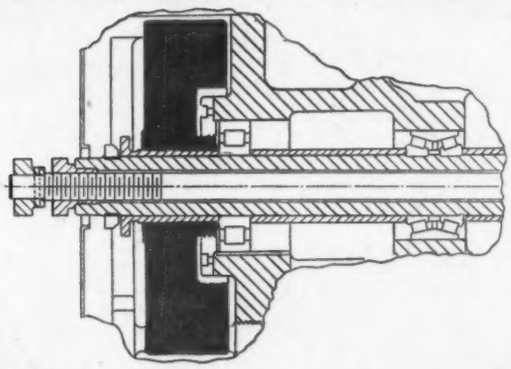
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

NEW Van Norman

No. 2 Heavy Horizontal Miller
Table: 58" x 13"
Motor: 7½ HP

No. 2 Heavy HORIZONTAL MILLING MACHINE

BUILT-IN FLYWHEEL



Improves Cutability... Increases Operator and Machine Output

The *new* Van Norman No. 2 Heavy Miller is especially designed to handle heavy milling operations faster, easier, at reduced costs.

Among its outstanding features is the new exclusive Van Norman spindle design which incorporates a heavy flywheel, mounted on the spindle inside the column, assuring uniform transmission of power to cutter. It improves cutability and assures a smooth finish on the work.

For ease of operating convenience, the No. 2 heavy has front and rear directional control of all power feeds. Actuated in the direction of desired table, saddle, knee movement, they add to operator safety. Rapid traverse is also provided with front and rear controls.

In addition front and rear manual hand feeds enable the operator to line up the cut from either location providing complete visibility in arranging the set-up. Exclusive Van Norman single lever speed and feed selectors provide quick changes of 18 speeds and 18 feeds.

Such construction features as massive column and overarm, large hardened alloy steel gears, hardened multi-splined shafts, taper roller bearings, automatic lubrication and large diameter feed screws assure long life and accurate performance.

The Van Norman No. 2 Heavy Horizontal Milling Machine is available with plain or universal saddle. Write for complete information, today.

VAN NORMAN COMPANY

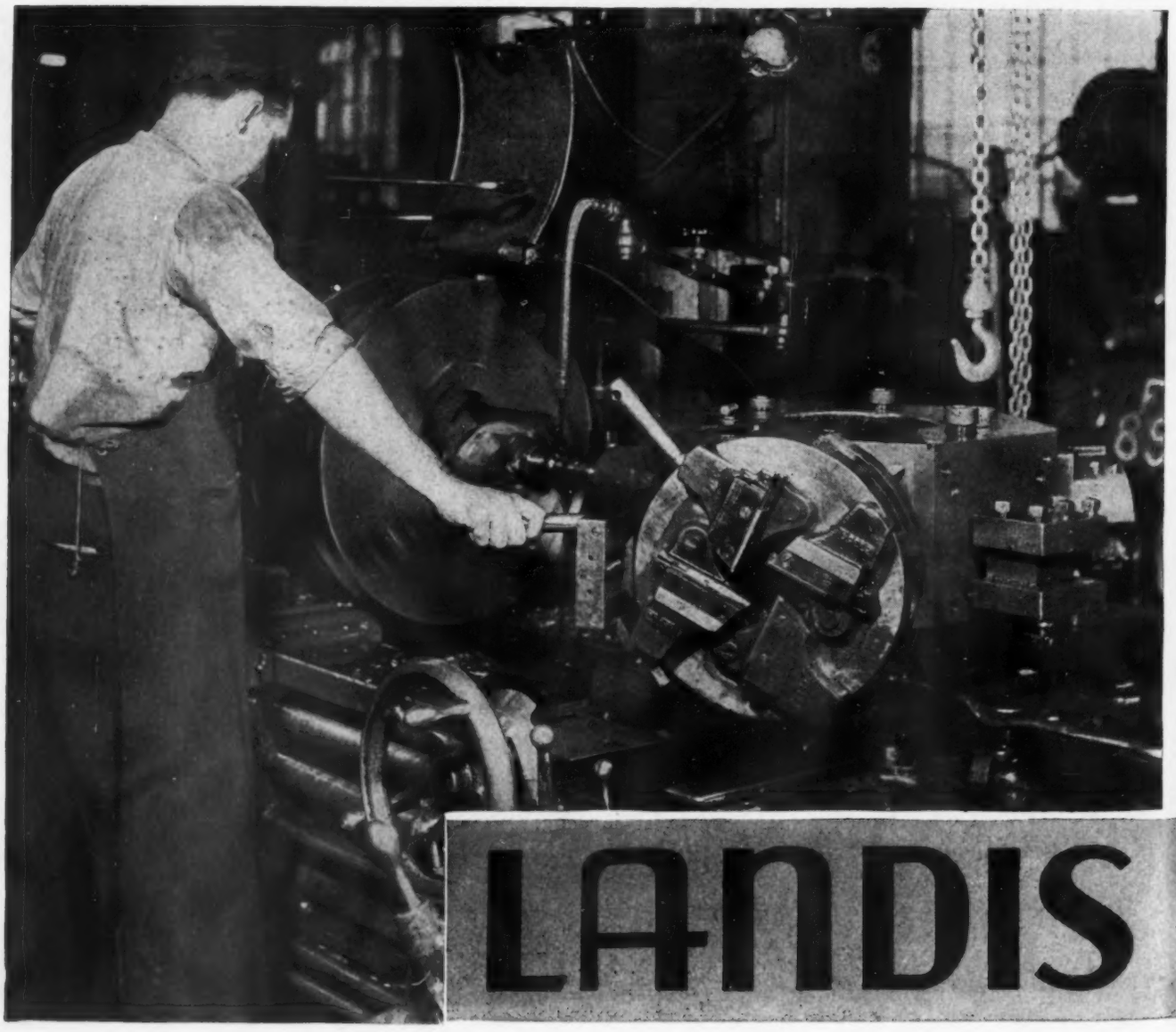
SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

For Turret Lathe and Hand Screw Machine Operations - the

LANDMATIC HEAT TREATED DIE HEADS ARE UNIVERSALLY USED

The Landmatic Head is designed especially for use on turret lathes and hand screw machines. Its sturdy rigid construction assures high operating efficiency and fine thread accuracy.



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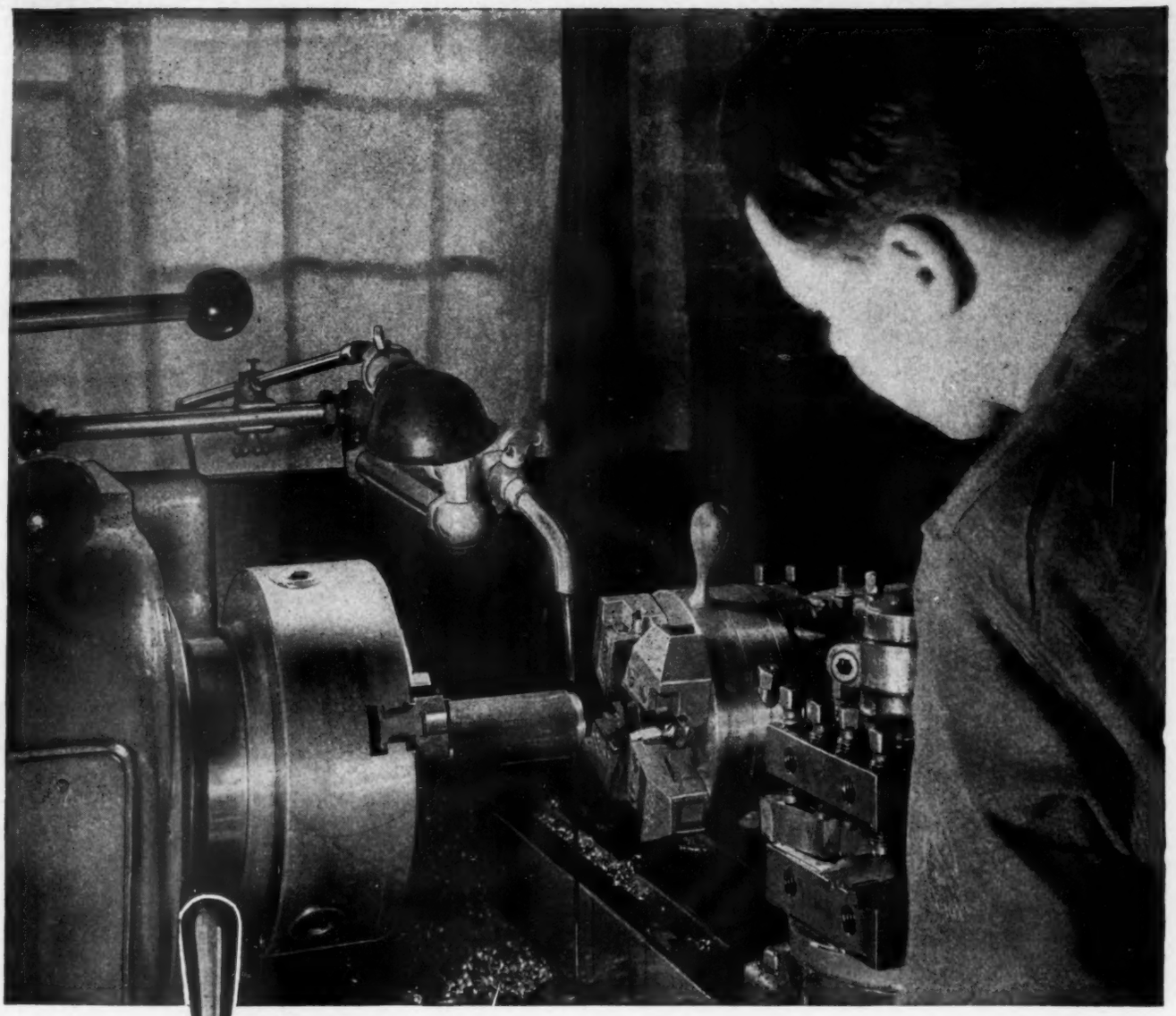

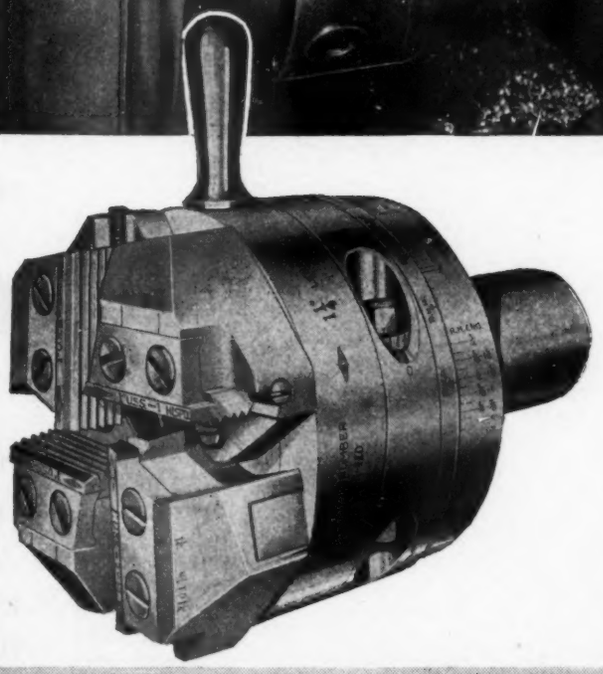

An eastern manufacturer of Gas, Steam, Air and Water Valves employs Landmatic Heads exclusively for threading Seat Rings and other valve components. Threads ranging in size from 1½ inches to 5 inches in diameter are cut with Landmatic Heat Treated Die Heads with an average saving of 30% of the cost of methods previously used. In the words of the manufacturer, "Figures definitely prove that Landmatic Heads are doing a BETTER job for us." Perhaps they may likewise do a better job on YOUR Turret Lathe Threading Operations.

Write for Bulletin F-90

MACHINE CO. WAYNESBORO PENNA. U.S.A.

First quality Tool Steels ...exclusively

High Speed Steels

Red Cut Superior	Neatro
E. V. M.	8-N-2
Red Cut Cobalt	Van-Lom
Red Cut Cobalt B	6-6-2
Gray Cut Cobalt	Vasco M-2

Die Steels for Hot Work

Marvel	Hotform
Choice	Hotpress
Extrude Die	Formdie

Die Steels for Cold Work

Non-Shrinkable	Airhard
Colonial No. 6	Crocar
Red Star Tungsten	Ohio Die

Colonial No. 4

Carbon and Carbon-Vanadium Tool Steels

Colonial No. 14	Colonial No. 7
Extra "L"	Red Star Vanadium
Red Star Tool Steel	Elvandi

Chrome-Vanadium Tool Steels

Vanadium Type D
Vanadium Type G
Vanadium Type H
Vanadium Type K
Vanadium Type N
Vanadium Type BB

Tool Steels for Special Purposes

Colhed	CM
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Facts

you can use with profit in every Tool Steel assignment . . .

Write for these Technical Brochures

All Tool Steels are available in billets, bars, hot rolled and cold drawn shapes, solid forgings, ring forgings, sheet, plate, circles and drill rod. Treated Tool Bits and Cut-off Blades available from stock in most High Speed Steel grades.

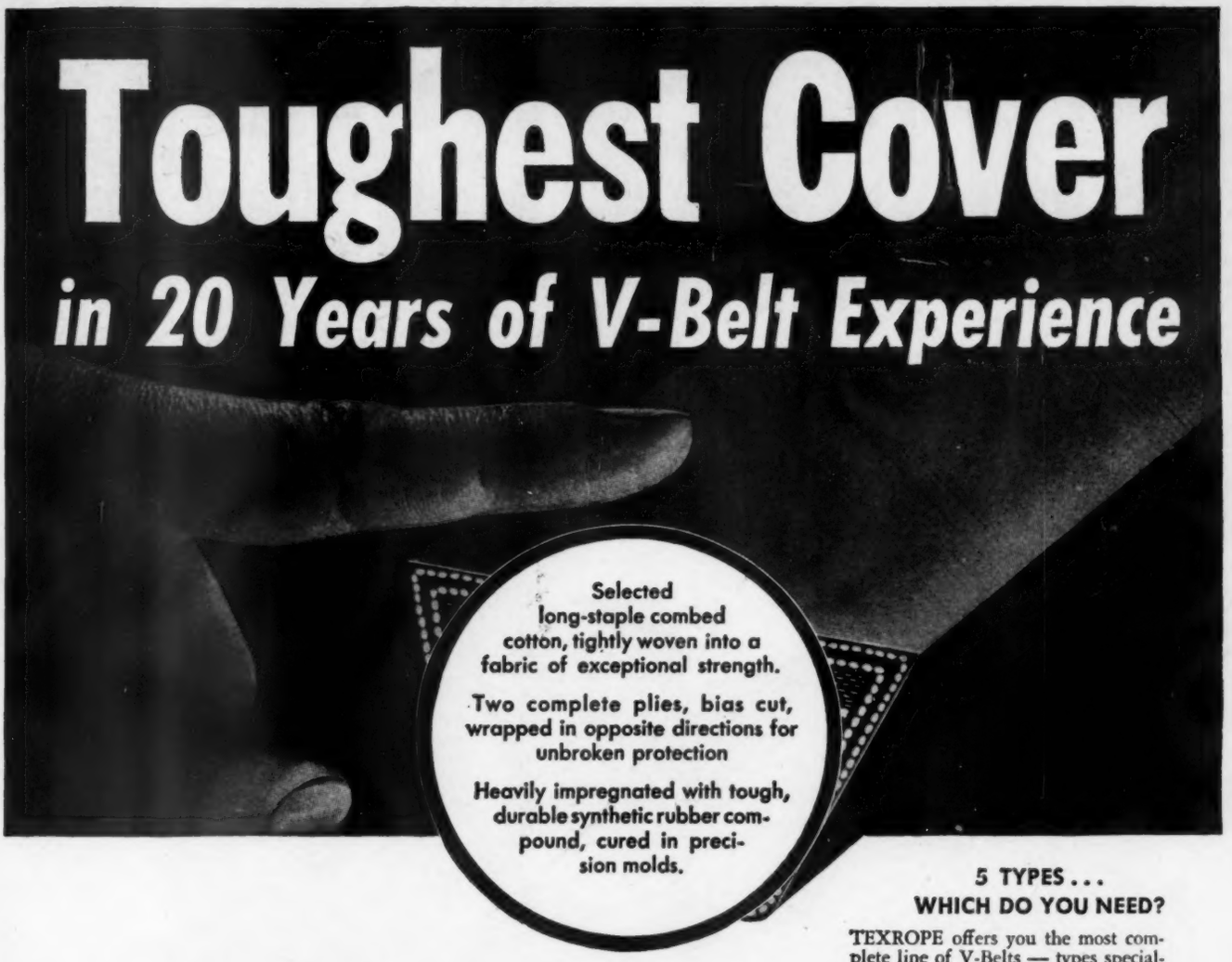
VANADIUM-ALLOYS STEEL COMPANY

First Quality Tool Steels

Latrobe, Pennsylvania

COLONIAL STEEL DIVISION . . . ANCHOR DRAWN STEEL CO.

Toughest Cover
in 20 Years of V-Belt Experience


Selected long-staple combed cotton, tightly woven into a fabric of exceptional strength.
Two complete plies, bias cut, wrapped in opposite directions for unbroken protection
Heavily impregnated with tough, durable synthetic rubber compound, cured in precision molds.

Allis-Chalmers Builds Longer Life Into Famous TEXROPE V-Belts

A V-Belt is no better than its COVER. And . . . TEXROPE Super-7 belts today carry the toughest, most wear-resistant cover that Allis-Chalmers has developed since they invented the Multiple V-Belt Drive! It's the result of 20 years of continuous research and improvement.

This tough, resilient sheath is unbroken and unweakened by grooves or serrations. It takes the wear, holds the belt in shape, protects the load-carrying core structure.

Added Strength — Smoother, Cooler Running

50% Stronger Cords, impregnated with friction-fighting gum rubber. *War-proved Buna-S,* better, cooler-running than natural rubber. *Perfect Balance,* every belt accurately proportioned, precision molded to run true and cool. Make Allis-Chalmers your V-Belt headquarters! ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

A 2003

5 TYPES . . . WHICH DO YOU NEED?

TEXROPE offers you the most complete line of V-Belts — types specially developed to meet ALL operating conditions. Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission.

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

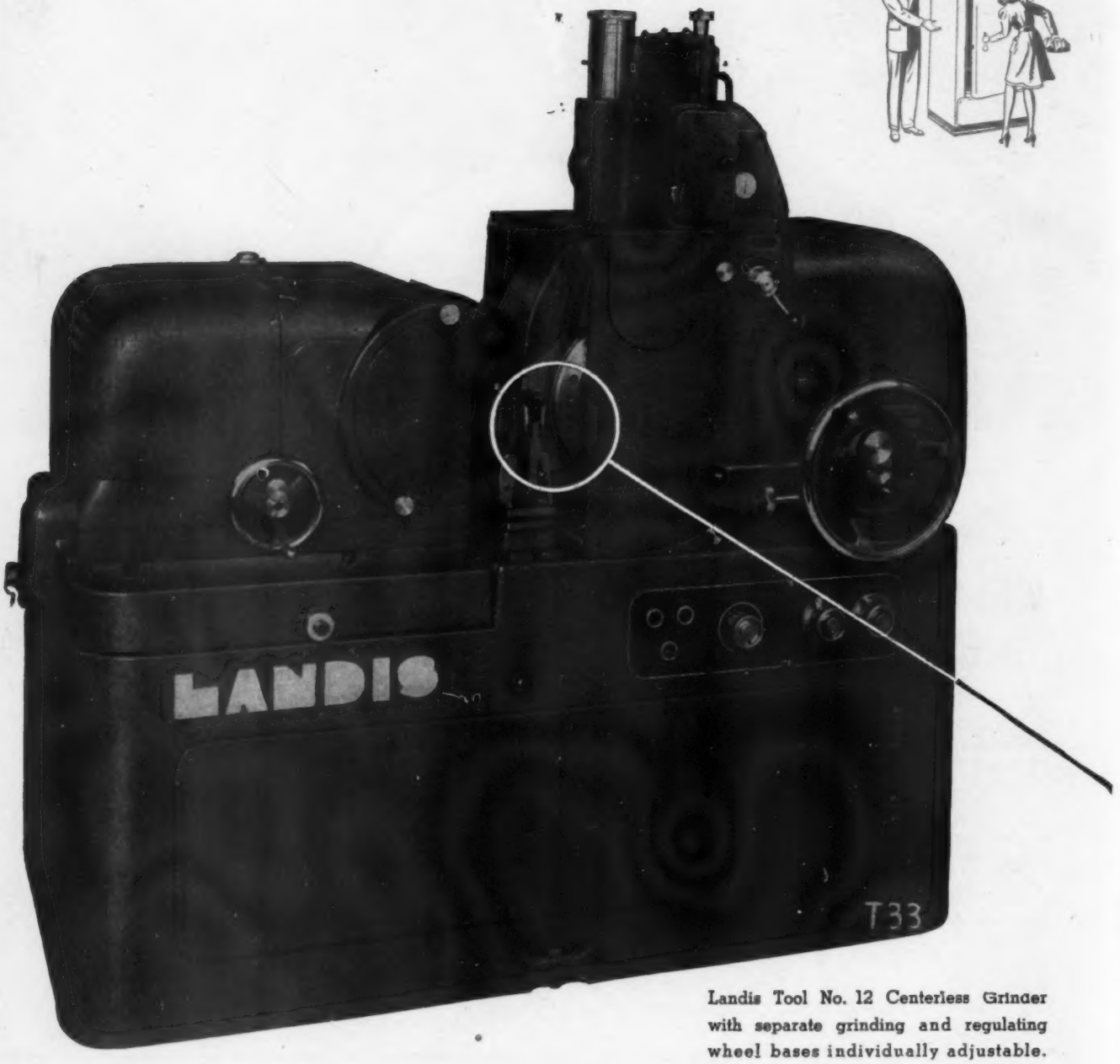
TEXROPE Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

V-BELTS
TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS
TEXROPE V-BELT DRIVES
ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

360 CRANKSHAFTS



Landis Tool No. 12 Centerless Grinder with separate grinding and regulating wheel bases individually adjustable.

LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

PER HOUR with Centerless Infeed Grinding

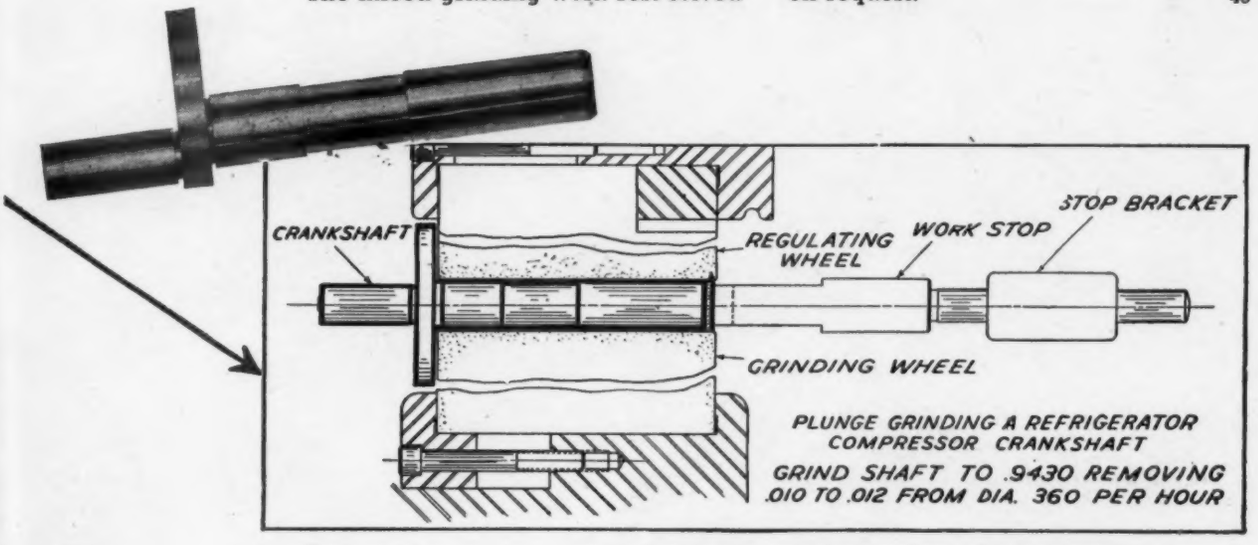
Infeed Grinding Work Rest Brings Centerless High Production To Shoulder Grinding

A refrigerator manufacturer had a problem of cost reduction and increased output of compressor parts. Sales inducements like five year guarantees and sealed units made it imperative that quality be maintained or improved.

When the job was turned over to Landis Tool grinding engineers they recognized that the high production requirements and fine finish called for centerless grinding.

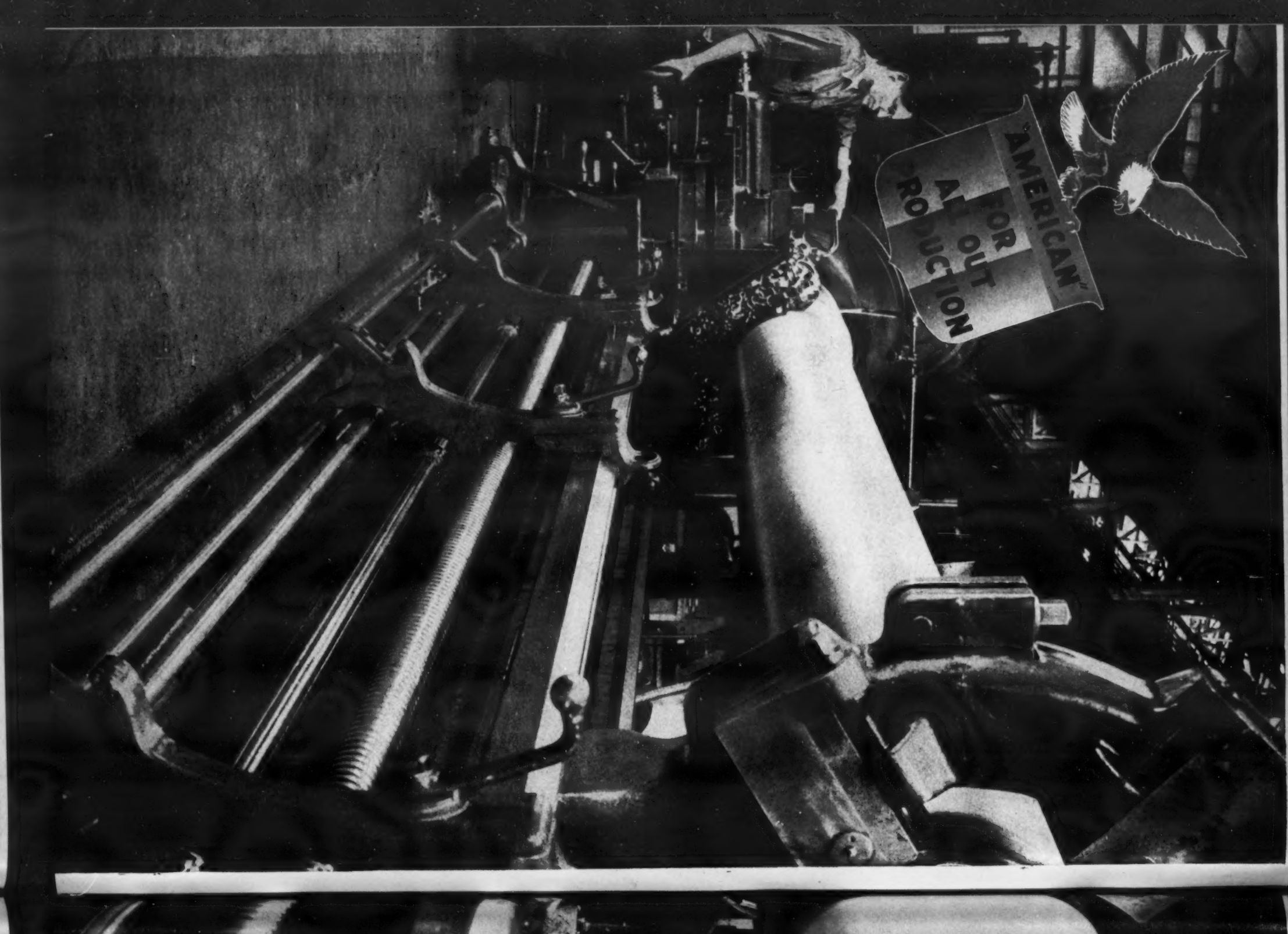
The infeed grinding work rest solved the crankshaft grinding problem and with its adjustable feature made possible infeed grinding of the refrigerator compressor piston also. Production of both by infeed grinding was at the rate of 360 units per hour—a substantial production increase that lowered costs.

For help with your grinding problems, call on Landis Tool for Engineered Grinding Service. Catalog T-44 gives full information on the Centerless—available on request. 46


CRANKSHAFT
REGULATING WHEEL
WORK STOP
STOP BRACKET
GRINDING WHEEL
PLUNGE GRINDING A REFRIGERATOR COMPRESSOR CRANKSHAFT
GRIND SHAFT TO .9430 REMOVING .010 TO .012 FROM DIA. 360 PER HOUR

LANDIS TOOL Company

WAYNESBORO, PENNA.


AMERICAN
FOR
OUT
A
RODUCTION

VISUAL PROOF

These tough jobs emphasize the superiority of "AMERICAN" Super-Productive Lathes.

They also turn the spotlight upon the necessity for HARDENED ALLOY STEEL INTERNAL FACE PLATE RING GEARS—ADEQUATE SPINDLE AND SHAFT BEARINGS TO ABSORB THE ENORMOUS BEARING LOADS AND PARTICULARLY UPON THE NECESSITY FOR POWER, STABILITY AND OVER-ALL RUGGEDNESS.

"AMERICAN" Super-Productive Lathes provide these essentials.

Bulletin No. 87 gives all the facts.

THE AMERICAN TOOL WORKS COMPANY

Lathes and Radial Drills

CINCINNATI, OHIO, U. S. A.

You can do those surfacing jobs better when you use

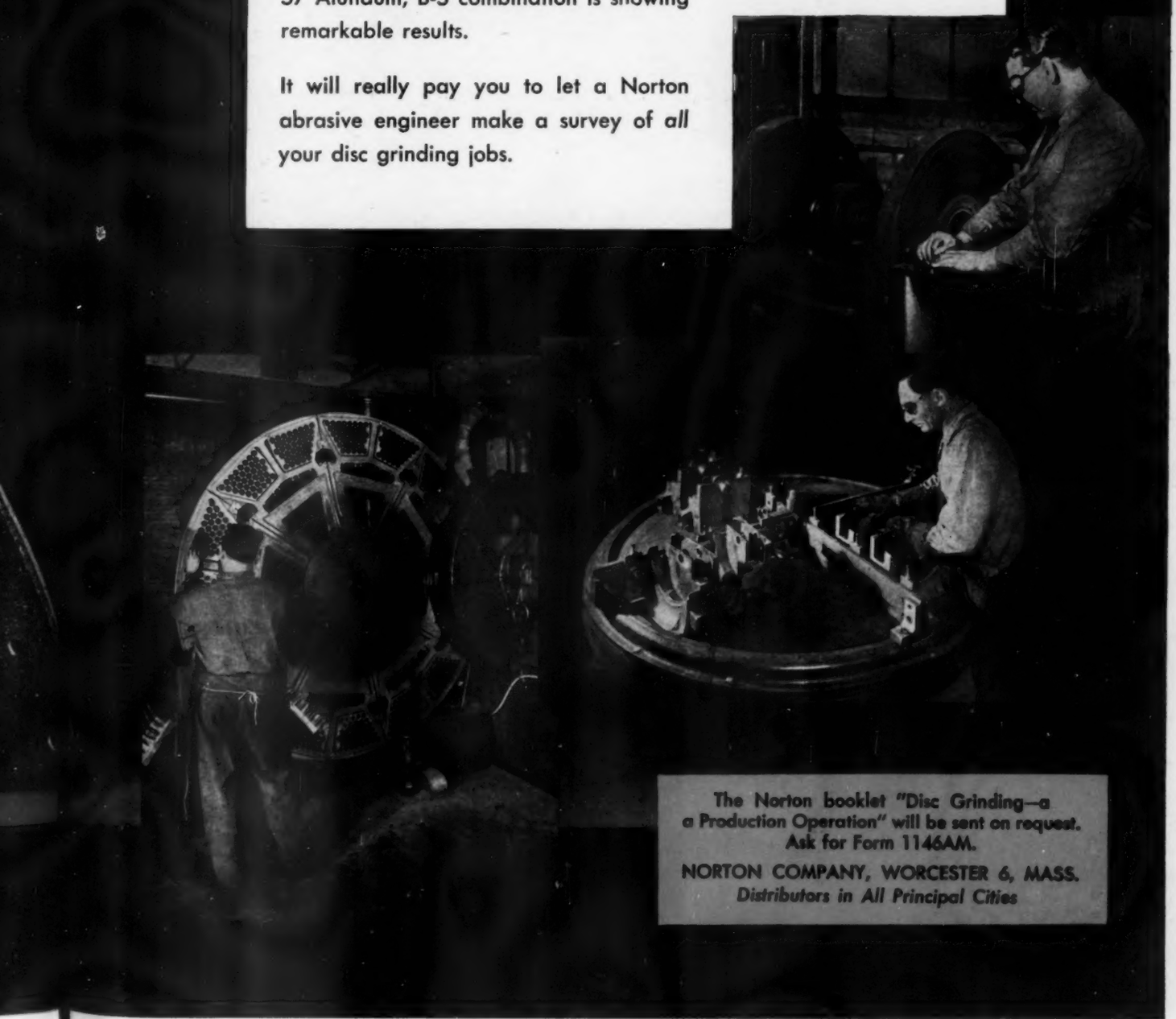
NORTON DISC WHEELS

NORTON ABRASIVES

WHEN a Norton abrasive engineer tackles your disc grinding jobs he's not limited to a few styles of discs—he has the complete Norton line of abrasives and bonds to choose from. As a result he can "tailor" the disc's grinding action to exactly meet your specific conditions—and that means lower surfacing costs.

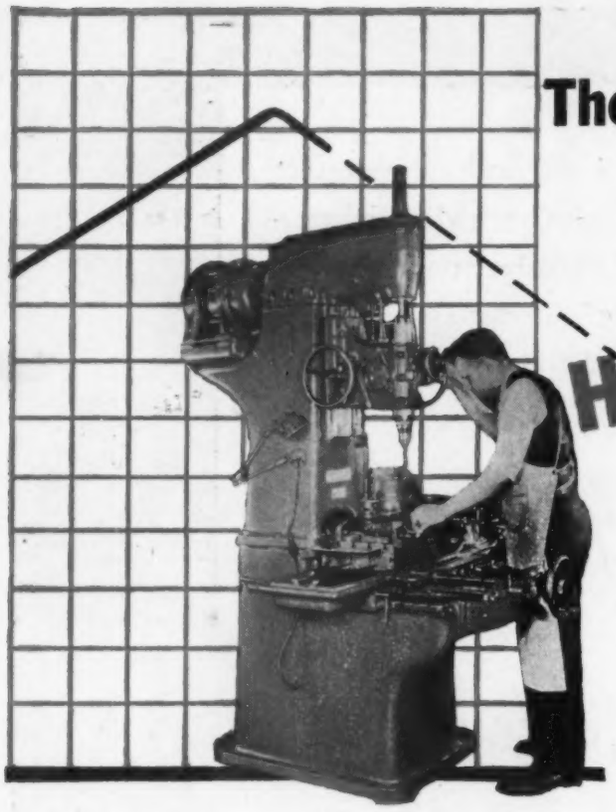
And what's more, he can take advantage of all the newest Norton developments—such as free-cutting 57 Alundum abrasive and B-5 bond. On many disc grinding jobs, especially surfacing castings, this 57 Alundum, B-5 combination is showing remarkable results.

It will really pay you to let a Norton abrasive engineer make a survey of *all* your disc grinding jobs.



The Norton booklet "Disc Grinding—a a Production Operation" will be sent on request. Ask for Form 1146AM.

NORTON COMPANY, WORCESTER 6, MASS.
Distributors in All Principal Cities



The Answer to a MENACE!!!

HOW TO THWART *Inflation*

INFLATION is our country's greatest menace today.

INFLATION is caused by low production inadequate to meet the demand for goods. Low production is caused by:

Restricted productive operation
High production costs

INFLATION can be licked by:

Increasing production
Cutting production costs

Cutting production costs is the function of the machine tool. Thus, today, the machine tool builders of America are meeting this challenge of inflation and are creating an opportunity to help build an expanding economy for the nation.

For more than 85 years Pratt & Whitney has been in this continuing battle to lower production costs by building better precision-made machine tools, small tools and gages.

Let us help you in this fight to cut production costs and lick the menace of inflation.

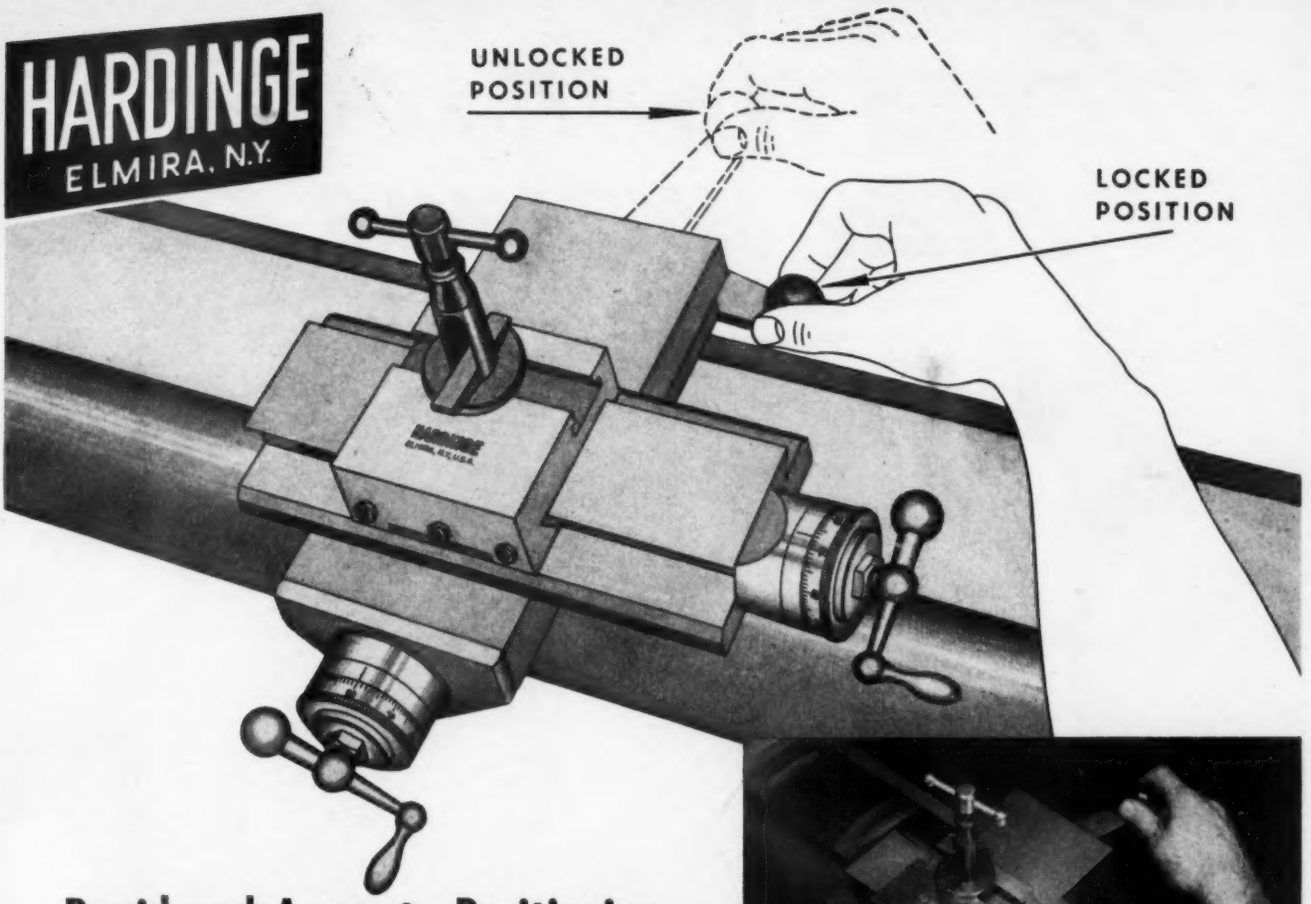
Write on your company letterhead to the address below for a copy of our Condensed Catalogue which contains information on our complete line.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

HARDINGE
ELMIRA, N.Y.

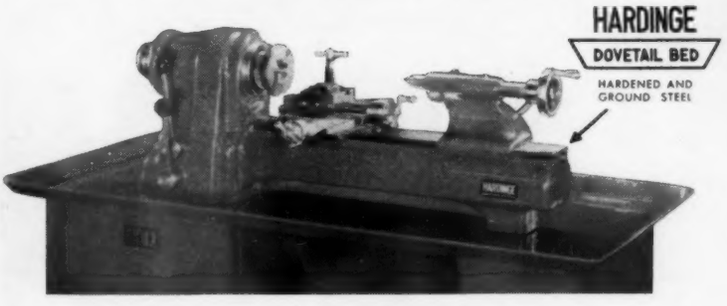


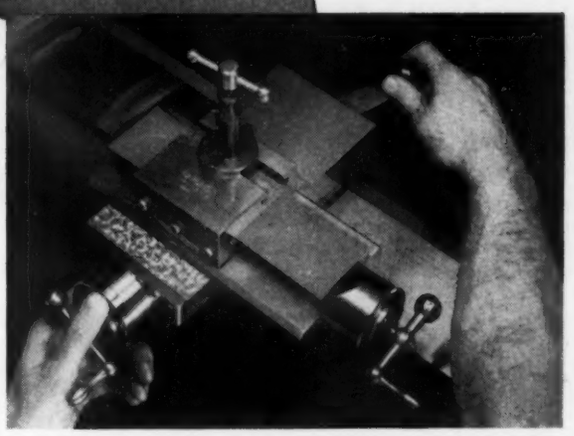
Rapid and Accurate Positioning with HARDINGE Compound Slide Rest

This compound slide rest obsoletes all other compound slide rests due to speed and accuracy of operation. It can be applied or removed from the HARDINGE Dovetail Bed in five seconds or less, making it the fastest positioning compound slide rest known. Also, when removed from the dovetail bed and reapplied, it will repeat previous index slide settings in relation to the spindle centerline. This cannot be said for ordinary compound slide rests.

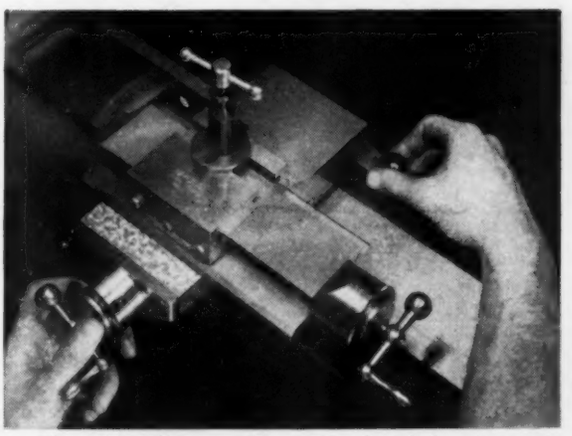
OTHER FEATURES: Hardened and ground steel index slide section; large hardened feed screws mounted on preloaded ball bearings; easy-to-read 2″ diameter feed screw dials; index slide swivels 360° and has two independent locks; solid bottom slide does not have a weakening T-slot for conventional bed bolts.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.





In the unlocked position, the quick-acting lock is released, permitting the Hardinge Compound Slide Rest to be moved along the bed ways or lifted from the machine.



The Hardinge Compound Slide Rest is rapidly and accurately locked in any desired position on the bed ways by a simple 90° movement of the lever.

HERE'S WHAT YOU'VE BEEN WISHING FOR...

Check
Clip
Mail

Manager, CIMCOOL Division
Cincinnati Milling Machine Co.
Cincinnati 9, Ohio, U. S. A.

AM-6

_____Please send me a copy of "What Is Cimcool?"

_____Please have sales representative call.

Name_____

Company_____

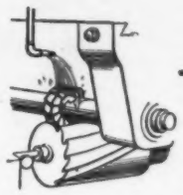
City_____State_____

CIM

One Cutting Fluid That Covers 85% of ALL JOBS!

Yes, it's true! CIMCOOL replaces all water emulsions and all but very highly compounded specialty oils . . . actually handles 85 per cent of all metal working operations . . . does it at lower cost and does it better, for CIMCOOL combines high cooling capacity with high friction reduction in a degree never before attained.

CIMCOOL was developed *and is used by* the world's largest machine tool builder. Investigate today!



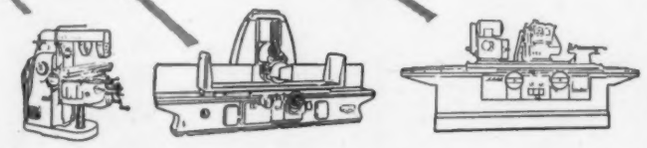
A CASE IN POINT After switching to CIMCOOL on difficult milling operations, the King Machine Tool Company of Cincinnati states: "We have had an increase of about 50 per cent in tool life . . . and at the same time we have increased speeds and feeds." The company further reports that CIMCOOL has made a big hit with its operators and its use has eliminated all signs of dermatitis.

Division of

THE CINCINNATI MILLING MACHINE CO.

Cincinnati 9, Ohio, U.S.A.

The Multi-Purpose Cutting Fluid



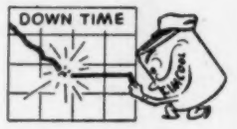
COOL

Why CIMCOOL will help YOU increase efficiency... lower costs!

CIMCOOL helps increase production rates. Increased cooling capacity permits higher cutting speeds and feeds. Grinding wheels cut more freely. Low surface tension allows small chips and grit to settle out rapidly.

CIMCOOL helps increase tool life. Chemical lubricity reduces tool wear. Tools are kept cool to touch. Increased wetting action permits greater penetration between tool and chip.

CIMCOOL reduces downtime on machines. Fewer tool changes and fewer changes of cutting fluid are necessary. Pump and supply lines are kept clean. No spoilage.



CIMCOOL facilitates accuracy. Freer cutting reduces pressure. Uniform temperature is maintained on work and on machine. Dirt does not stick to work or gages, permitting faster, more accurate gaging.

CIMCOOL is tops with operators. It restricts bacterial growth, does not contain animal or vegetable oils subject to rancidity, and is not a skin irritant. Smoke, objectionable odors and hot chips are eliminated.

CIMCOOL is safest. Fire hazards are eliminated. Absence of slippery film on operator's hands, machine controls, work and floor reduces danger of accidents. Restriction of bacterial growth limits risk of infection.

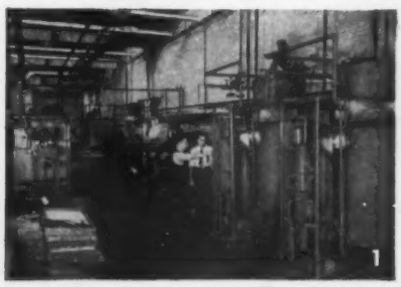
CIMCOOL contains a rust inhibitor good for the life of the fluid for protection of machine and work. It contains no chromates or highly alkaline components which may be irritating to the skin.

CIMCOOL is applicable to 85% of all metal-working operations requiring cutting fluids. It replaces all water emulsions and all but very highly compounded specialty oils for selected jobs.

Worried about Rising Production Costs?

Find out today about EX-CELL-O's Complete Facilities for Manufacturing Parts and Sub-Assemblies

Leadership in developing advanced manufacturing methods . . . long years of engineering experience . . . modern and complete facilities . . . that have given Ex-Cell-O an outstanding record in production for war—*all these can help you solve the problem of mass production of accurate parts and sub-assemblies for your new or redesigned products.* Ex-Cell-O, with machining, heat-treating, grinding and assembling and inspection facilities *all under one management,* offers you many practical advantages. Send your print or part or sketch to Ex-Cell-O in Detroit today, or get in touch with any member of Ex-Cell-O's field engineering staff in 32 of the leading industrial centers in the United States and Canada.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3

EX-CELL-O CORPORATION

XLO

EX-CELL-O for PRECISION

EX-CELL-O's *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

HEAT TREAT

Induction Heating
Laboratory for Heat Treat Control Including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Centerless Grinders
Single and Multiple Spindle Drilling Equipment
Heli-O.D. Grinders
Main I.D. Grinders
Milling Machines
Broaching Machines
Precision Thread Grinders
Precision Boring Machines
Lapping Machines
Special High Production Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accidents but quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the manufacturing process.

To left: **If you do not now receive Ex-Cell-O TOOL TIPS, devoted to precision, speed and economy in production, send your name, company, address and position to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.**

Illustrations below: **A few miscellaneous views of some Ex-Cell-O heat treat facilities, considered among the most modern and complete in American Industry.**

3

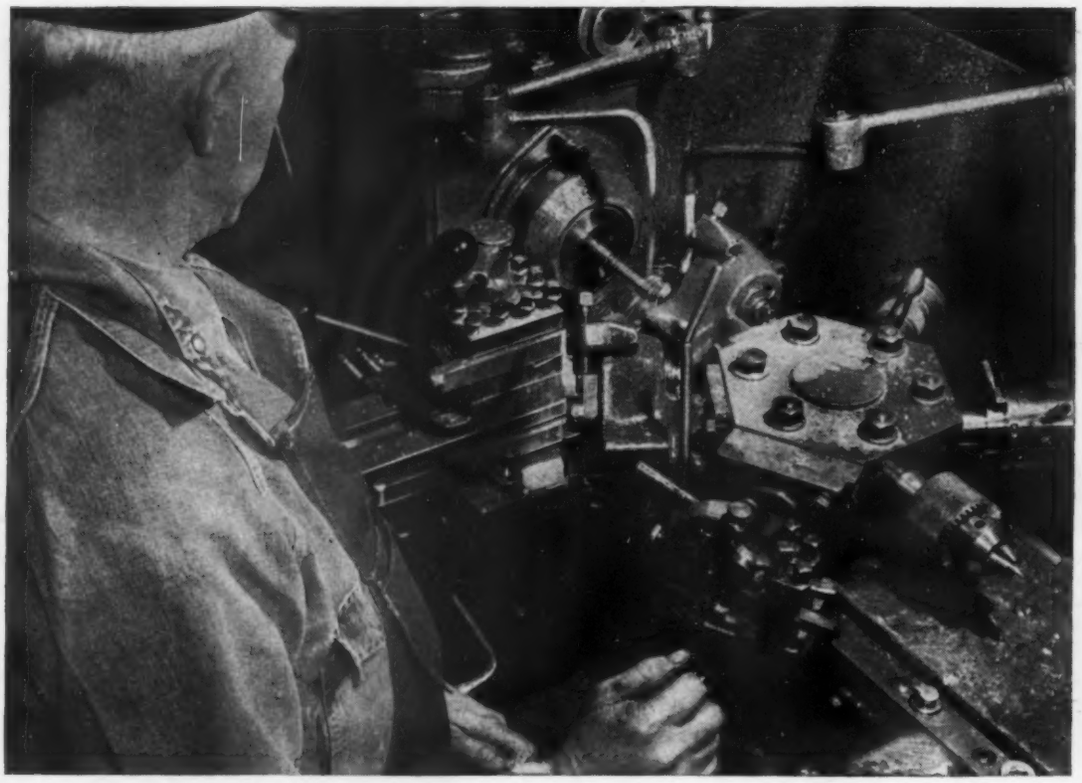
4

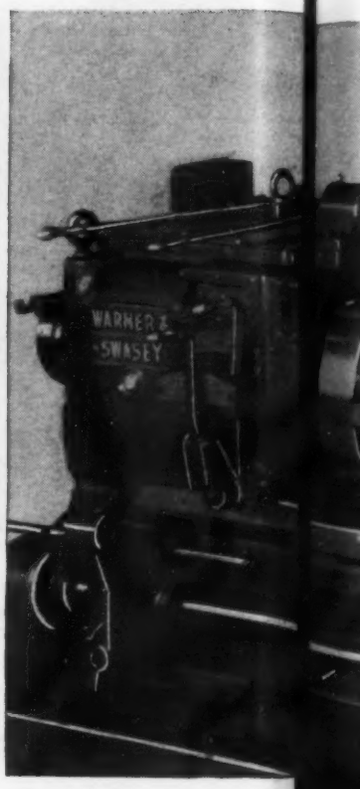
5

DETROIT 6, MICH.

Cutting Seconds a

FROM OUNCES ..





Turning time is clocked in seconds on small precision parts such as the worm gear shaft shown above. It is being machined at high speed on a Warner & Swasey No. 3 Universal Turret Lathe, with tolerances held to .0005. The mirror-like finish produced also saves time and cuts costs by eliminating need of grinding.

★ Metal turning calls for a wide variety of jobs, from precision work on small parts weighing less than an ounce to accurate machining of castings and forgings weighing over a ton. But regardless of size of the part, bigger profits result from the jobs that are turned most quickly, accurately and economically.

And fast, accurate, low-cost production is an assured dividend when you invest in a Warner & Swasey Turret Lathe.

You get *fast production,* because the power and rigidity of a Warner & Swasey permit full use of carbide cutters in taking heavy combined and multiple cuts at higher speeds.

You get *accurate production,* because the precision of Warner & Swaseys makes possible holding true to extremely close tolerances—.0005 in many instances.

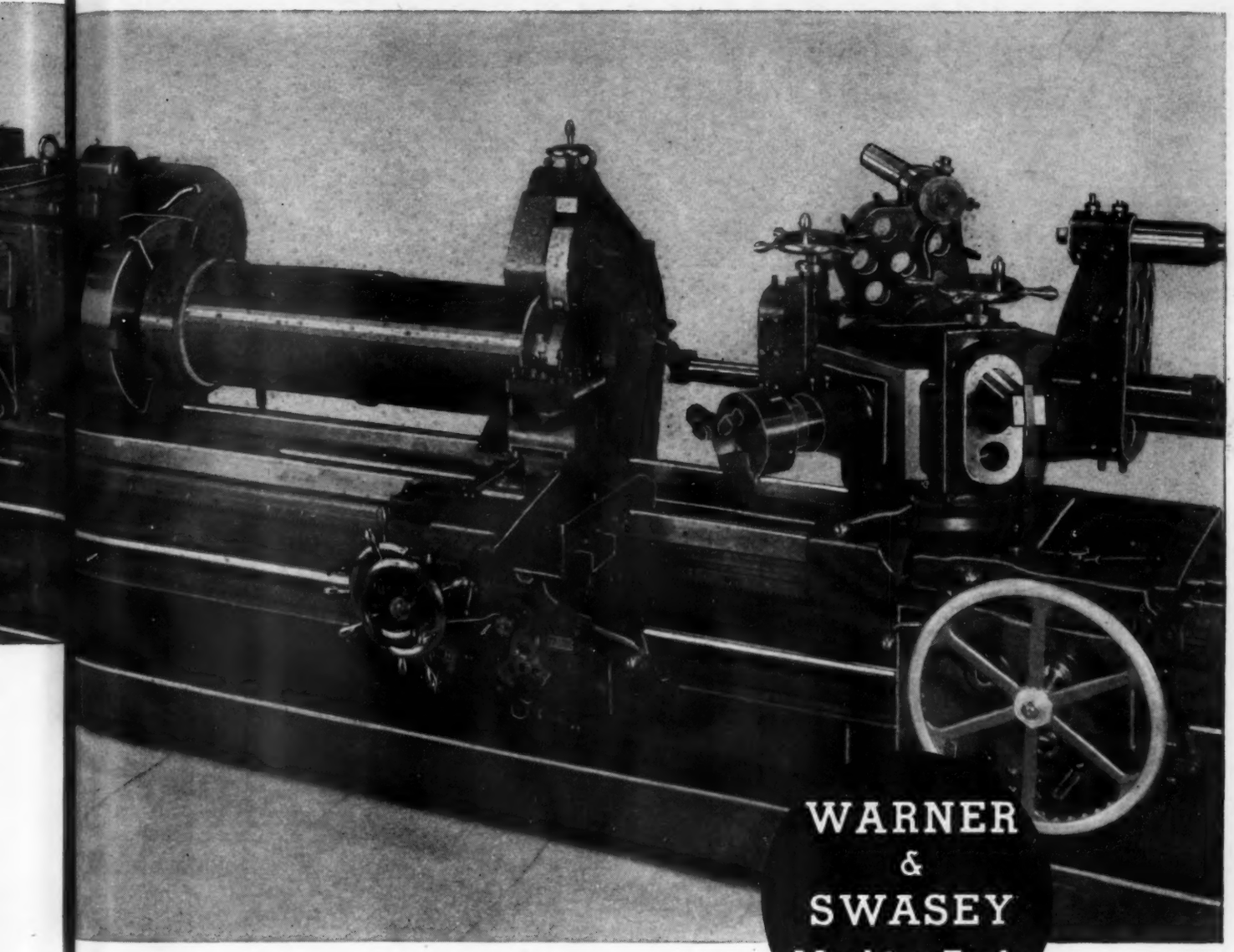
You get *low-cost production,* because the speed, accuracy and ease of operation of a Warner & Swasey Turret Lathe all combine to save time and money through higher output with minimum scrap loss.

Whether you turn small or large parts, perhaps we can help you produce them more profitably—either on new Warner & Swaseys, or by suggesting new tools or accessories to make your present turret lathes more productive. Why not ask a Warner & Swasey field engineer? Or write Warner & Swasey, Cleveland 3, Ohio.

You can machine it better, faster f

and Minutes

...AND TONS



Many cost-cutting minutes are saved in machining this heavy steel shaft housing, 10" in diameter and 4' in length, by using a Warner & Swasey Heavy Duty Turret Lathe equipped with extra long bed and roller steady rest. Of special interest is the use of a pilot bushing mounted in the steady rest so as to utilize standard multiple turning heads with overhead pilot bars.

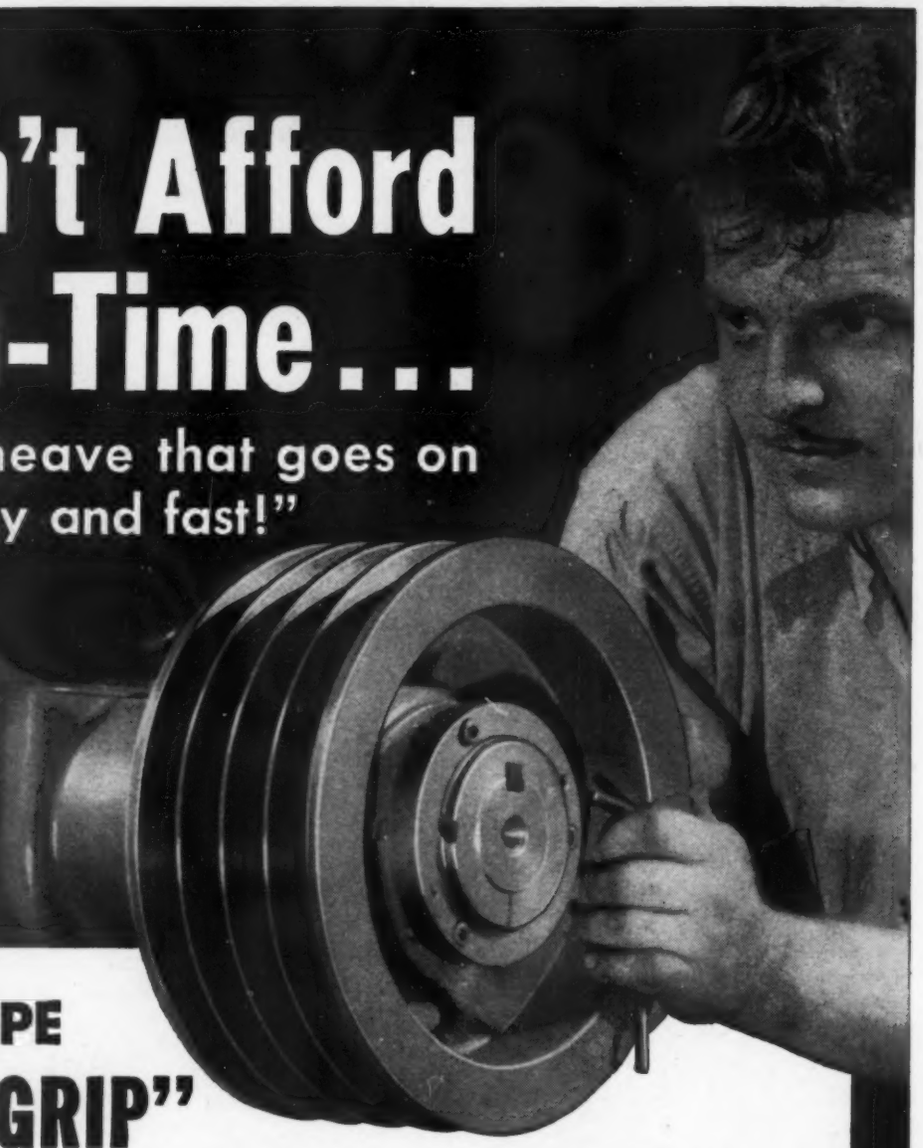
WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

for less... with a Warner & Swasey

"I Can't Afford Down-Time . . .

I need a sheave that goes on and off easy and fast!"



TEXROPE "MAGIC-GRIP"

. . . Fastest Mounting Sheave Ever Made!

Saves manhours . . . this improved sheave with "Magic-Grip" bushing comes completely assembled. You slide it on the shaft to exact position, tighten three cap screws — and it grips like magic. No filing or scraping, no hammering. And it comes off just as easily!

More advantages: "Magic-Grip" sheave *mounts close to the motor.* Less overhang, less vibration, less strain on bearings. *Clamp fit can't damage shaft.* No wobble, shear or backlash.

You get these advantages without increase in prices! See "Magic-Grip" sheaves — at your nearest A-C district office or dealer. For literature, write to ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

A 2004

V-BELTS

TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS

TEXROPE V-BELT DRIVES

ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES

"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

Warco PRESSES

The Finest Line of

WELDED STEEL PRESSES

Weldments fully stress-relieved

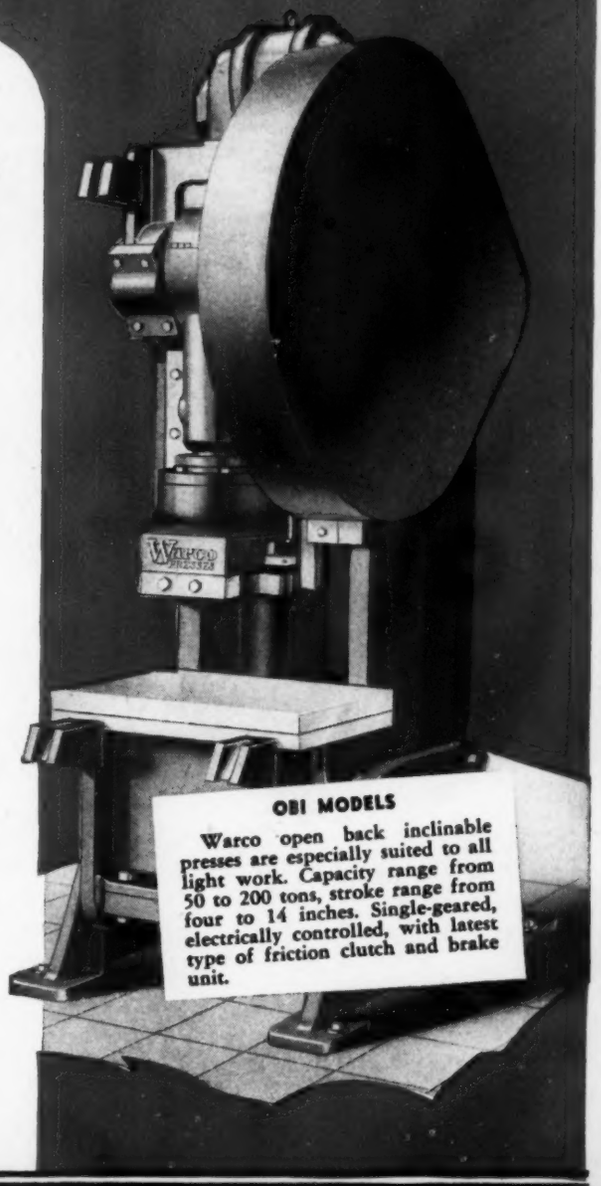
Don't Let Delayed Delivery Hold Up Your Program

If getting prompt delivery of a new press is holding up your production program, you will be interested in how Warco is helping scores of metal fabricators.

Exceptionally large engineering and production facilities enable us to deliver the press you need much sooner than many other manufacturers.

Warco presses are the most modern welded steel presses made, offering advantages that experience has shown are most desired by press users. They're engineered specifically for greater rigidity, accuracy, strength, power and endurance.

Warco's experienced press builders give personal attention to your specialized problems. Your inquiry will receive prompt attention. We invite you to inspect our plant, the largest of its kind in the world.



OBI MODELS

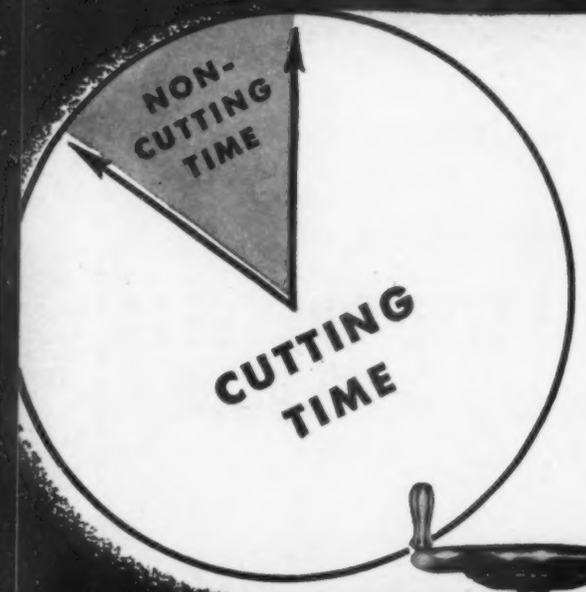
Warco open back inclinable presses are especially suited to all light work. Capacity range from 50 to 200 tons, stroke range from four to 14 inches. Single-geared, electrically controlled, with latest type of friction clutch and brake unit.

WARREN CITY MANUFACTURING COMPANY

1944 Griswold Street • WARREN, OHIO

A subsidiary of The Federal Machine and Welder Company . . . Offices in Principal Cities

ECCENTRIC GEAR PRESSES • HYDRAULIC PRESSES • PRESS BRAKES



48 of every is CUTTING

On the two jobs illustrated at right, Automatic Indexing Fixtures keep the cutters of the No. 12 Plain Milling Machine cutting over 80% of the operating time – at more than 4" feed per minute. Operator mounts work on an extra set of arbors while machine is cutting. Machine automatically stops after final cut, for reloading.

No. 12
PLAIN
MILLING
MACHINE
(Electrically Controlled)

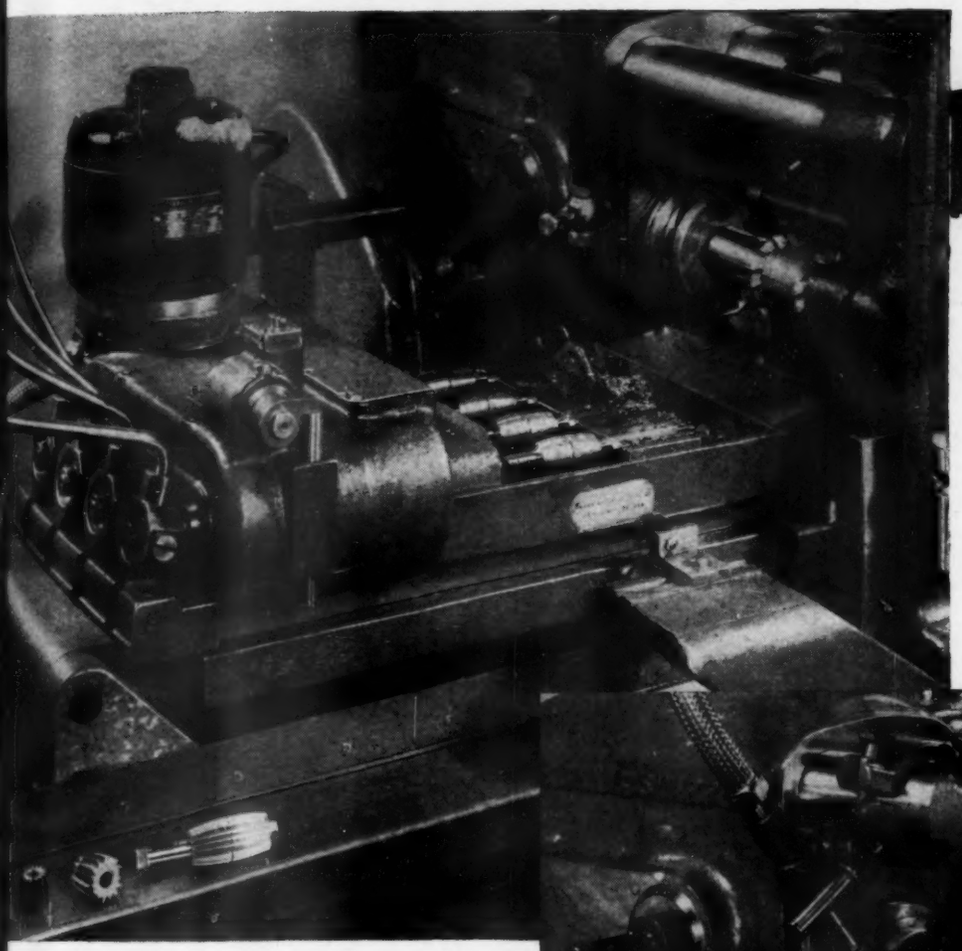
B·S

Write for detailed specifications.
Brown & Sharpe Mfg. Co.
Providence 1, R. I., U. S. A.

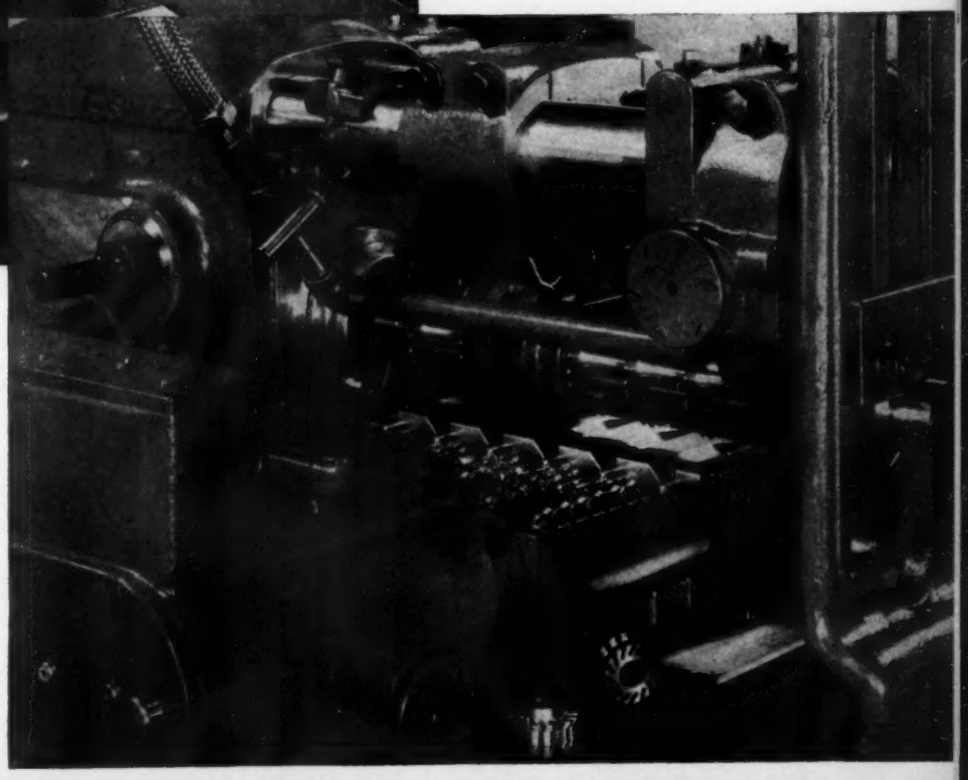
BROWN &

60 Minutes Time on No. 12...

WITH THESE 2 SET-UPS



Here grooves are being milled in boiler tube cleaners – eight pieces at a time. Work is automatically indexed after each cut. Climb milling is employed to force the work against the rigid center, and to provide a sharp edge (without burrs) on the teeth. The curved contour of the teeth is obtained by means of cams which guide the tilting fixture as it passes beneath the cutters. Indexing mechanism is operated by a torque motor connected to machine circuit.



This set-up shows teeth being cut in cutters used in shoe manufacturing. Cutters are mounted in gangs on six arbors, each arbor being indexed automatically. To eliminate cutter drag on the return stroke, the spindle head is raised automatically for return stroke and, after dropping back into position for the next cut, is automatically clamped. The indexing mechanism, head elevating mechanism, and arbor yoke clamping mechanism are air-operated, and controlled by solenoid air valves wired to the machine circuit.

& SHARPE

How to apply Multiple Tooling and Automatic Cycling to TURNING JOBS

Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

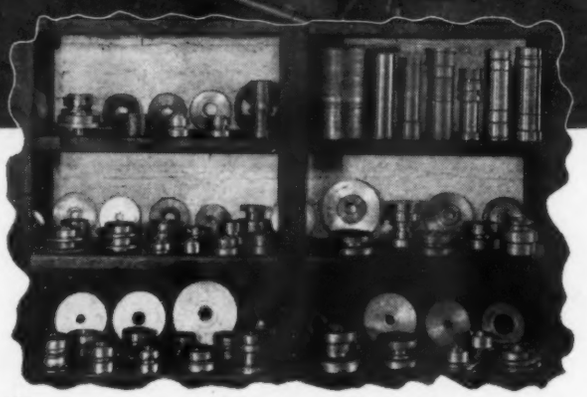
All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes.

Described here are three typical cases in which Sundstrand "Engineered" Production assisted plant engineers in designing a tooling method which resulted in lower turning costs.

MORE TURNING FACTS *Free*

This 44 page booklet, crammed full of technical data and production information shows how to apply multiple tooling to countless turning jobs. Short-run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 149.

SHORT RUN TURNING



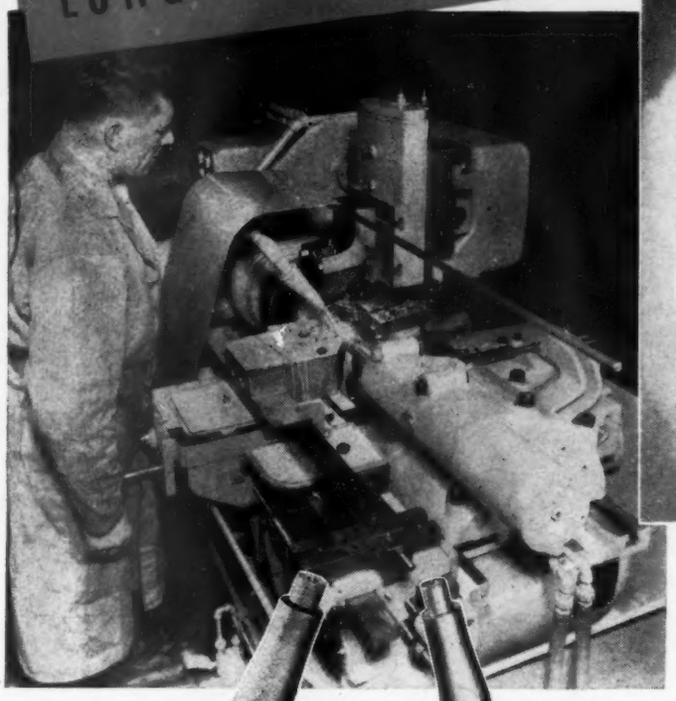
DUE to the quick changeover features of the Sundstrand automatic cycle, it is possible for this manufacturer to turn many of his jobs in lot sizes as low as 25. On one lot of 40 sleeves, his turning time was cut from 50 to 7 hours. Over 100 different parts are turned, including sprockets, pulleys, gears, etc., with lot sizes of 25 to 100 pieces.

Universal tool blocks, for adjusting tools to handle wide range of parts, keep tooling inventory to a minimum.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILL. U.S.A.

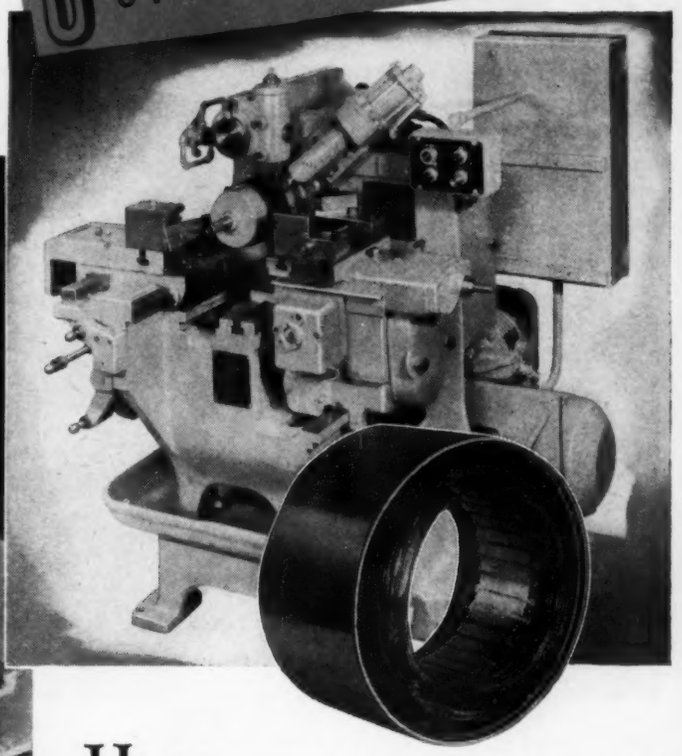
RIGIDMILS | FLUID-SCREW RIGIDMILS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT

2 LONG RUN TURNING



SUNDSTRAND'S unique cycle control mechanism is remarkably simple and easy to adjust. Consequently, the time saved in setting up the machine is also desirable for turning long runs. Here's an example: Six different steering knuckles are rough turned on this Sundstrand Model 12 Automatic Lathe. Operations include both straight and taper turning, facing and chamfering. With two complete sets of tool blocks, all parts are machined with a minimum of changeover time. Nine tools completely rough the stem end of the part in one machine cycle.

3 SPECIAL TURNING



HERE'S a special Sundstrand lathe which bores the I.D. of both ends, chamfers the I.D. and O.D. of both ends and faces the ends of a stator frame and coil assembly. Eight tools are used in this setup to complete the operation in one machine cycle. Machine and tool adjustments enable this equipment to be used on a number of different sizes of parts. A special short bed was provided so that operator position is convenient for loading, unloading and starting machine cycle.

SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES | SPECIAL MILLING AND TURNING MACHINES

Unexcelled Accuracy

DEVLIEG
MACHINE
COMPANY'S
PLANER DEPT.
Showing
Installations of
GRAY PLANERS

The De Vlieg Machine Co. pride themselves on their planer work, and state that the quality of their planer work is not surpassed in this country or abroad.

That they have the requisite tools to do such quality work can be seen from this view of their planer department.

Are you similarly equipped to economically produce quality work?

THE G. A. GRAY CO.
CINCINNATI 7, OHIO, U. S. A.

Gentlemen: Please send me without obligation on my part a copy of illustrated and descriptive bulletin No. 40-R-3.

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DOUBLE HOUSING and OPENSIDE PLANERS
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SWITCH PLANERS
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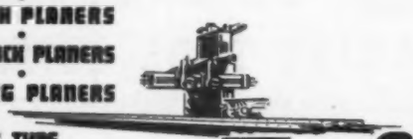
PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

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Sold in Canada by Upton, Bradeen and James Ltd. ● Sold in Latin America by Machine Affiliates.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

U. S. Rubber promises that its solid neoprene tires will reduce the power consumption of materials handling equipment as much as 60%.

get ready with CONE for tomorrow

Shell Development Company has patent rights to a new internally cooled piston in which the upper end of the connecting rod forms the top of the piston.

get ready with CONE for tomorrow

Glenn L. Martin Co. will make commercially available their war-developed process for printing photographs on almost any surface.

get ready with CONE for tomorrow

B. L. McClure Inc. of Norwalk, Ohio, has been licensed to manufacture a limited number of Hickey engines. This 2-cycle engine has variable compression adapting it to various fuels and loads.

get ready with CONE for tomorrow

Du Pont has announced a new plastic, called "Teflon", which resists acids including boiling sulphuric and aqua regia.

get ready with CONE for tomorrow

Promenette Radio & Television Corp. of Buffalo will make the electrical circuits on its radio sets by spraying metal lines on a plastic base.

get ready with CONE for tomorrow

Cleveland Transit System reports that its electrically heated switches performed well through last winter.

get ready with CONE for tomorrow

Eastman Kodak has two new photographic papers that can be developed in one minute, fixed in two and washed in four.

Chance-Vought has developed a building panel made of balsa wood surfaced with aluminum sheets.

get ready with CONE for tomorrow

The International Ice Patrol will go into service again equipped with planes and radar.

get ready with CONE for tomorrow

A Westinghouse engineer prophesies the use of gas turbines in ships and central power stations.

get ready with CONE for tomorrow

Allis-Chalmers reports that the 3500 h.p. multistage gas turbine that it designed and built for the Navy has been operated at a gas temperature of 1350 F.

The Bunker Hill Naval Air Station at Peru, Indiana, has had three winters' experience with runways made with a cement dispersing agent. There seems to be no deterioration from freezing or deicing chemicals.

get ready with CONE for tomorrow

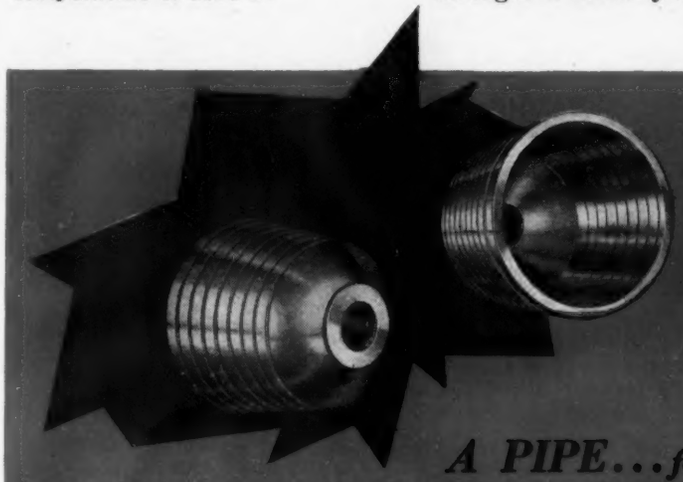
Ford Motor Co. has patents on an amphibious vehicle that looks like a small edition of the Army's famous "duck".

get ready with CONE for tomorrow

Buckminster Fuller's Dymaxion house is being readied for mass production by Beech Aircraft of Wichita. It is made largely of aluminum, weighs four tons, has 1017 sq. ft. of floor space and will sell for $6500.

get ready with CONE for tomorrow

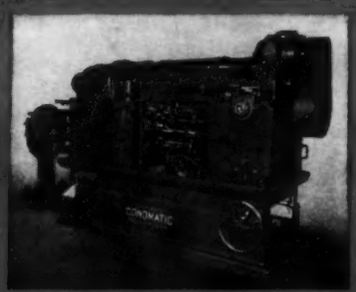
Monsanto has a chemical treatment for cotton called "Syton" that is claimed to increase the strength of cotton yarn 40%.



A PIPE . . . for You and for the 1¾" 8-Spindle Conomatic

The walls of this aluminum pipe bowl are machined to eggshell thinness, uniformly, with quality finish and with 15-second regularity. The Conomatic is adaptable for machining a variety of parts and built to handle tough or free-machining stock in its stride.

Follow these pages to keep well informed on up-to-date automatic production.



Ask your CONE *representative to show you our new color motion picture*

CONE

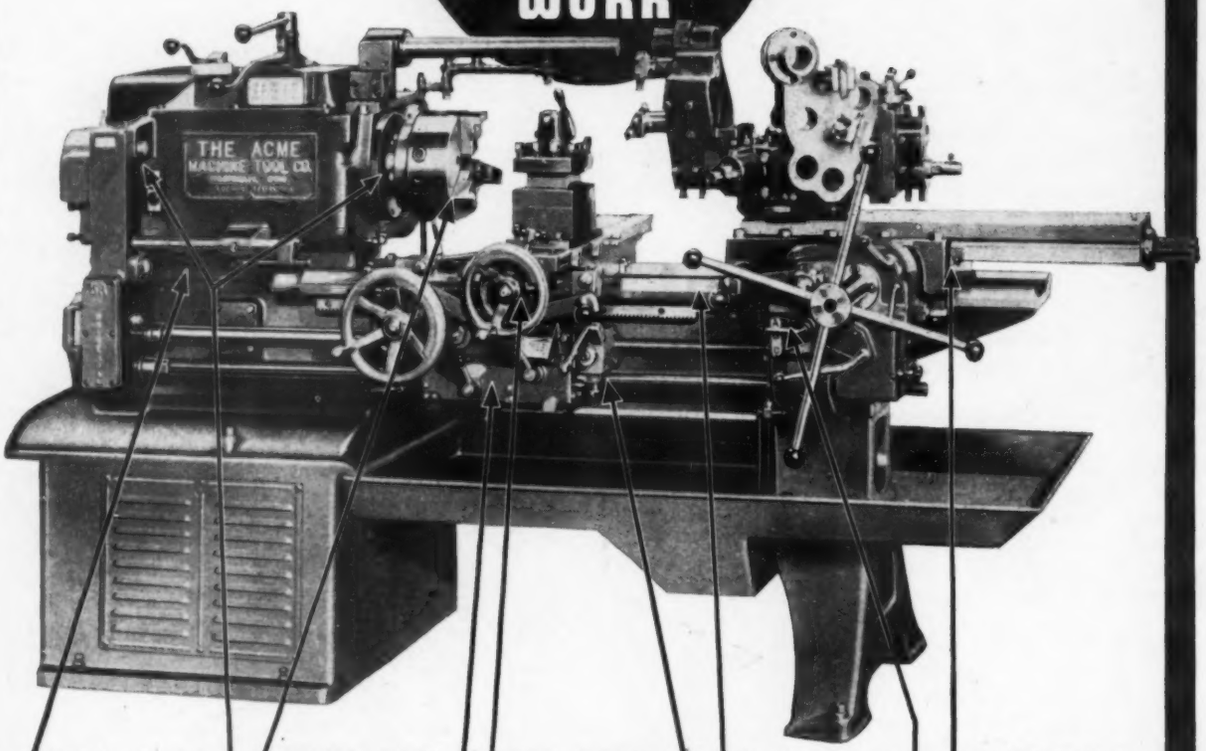
AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

30

ACME *Ram Type* TURRET LATHE

for accurate, speedy - low cost

CHUCKING WORK



- NON-OVER HANGING HEAD STOCK
- THREE JAW UNIVERSAL CHUCK
- TWIN-NUT BACK LASH ELIMINATOR ON CROSS SCREW
- HARDENED STEEL VEE'S ON BED
- HARDENED STEEL RAM SLIDE BEARINGS
- TRIPLE ROLLER SPINDLE BEARINGS
- INDEPENDENT FEED RANGES FOR EITHER APRON
- SIDE CARRIAGE APRON TAPER GIBED TO FRONT BEARING ON BED
- INDEPENDENT FEED RANGES FOR EITHER APRON

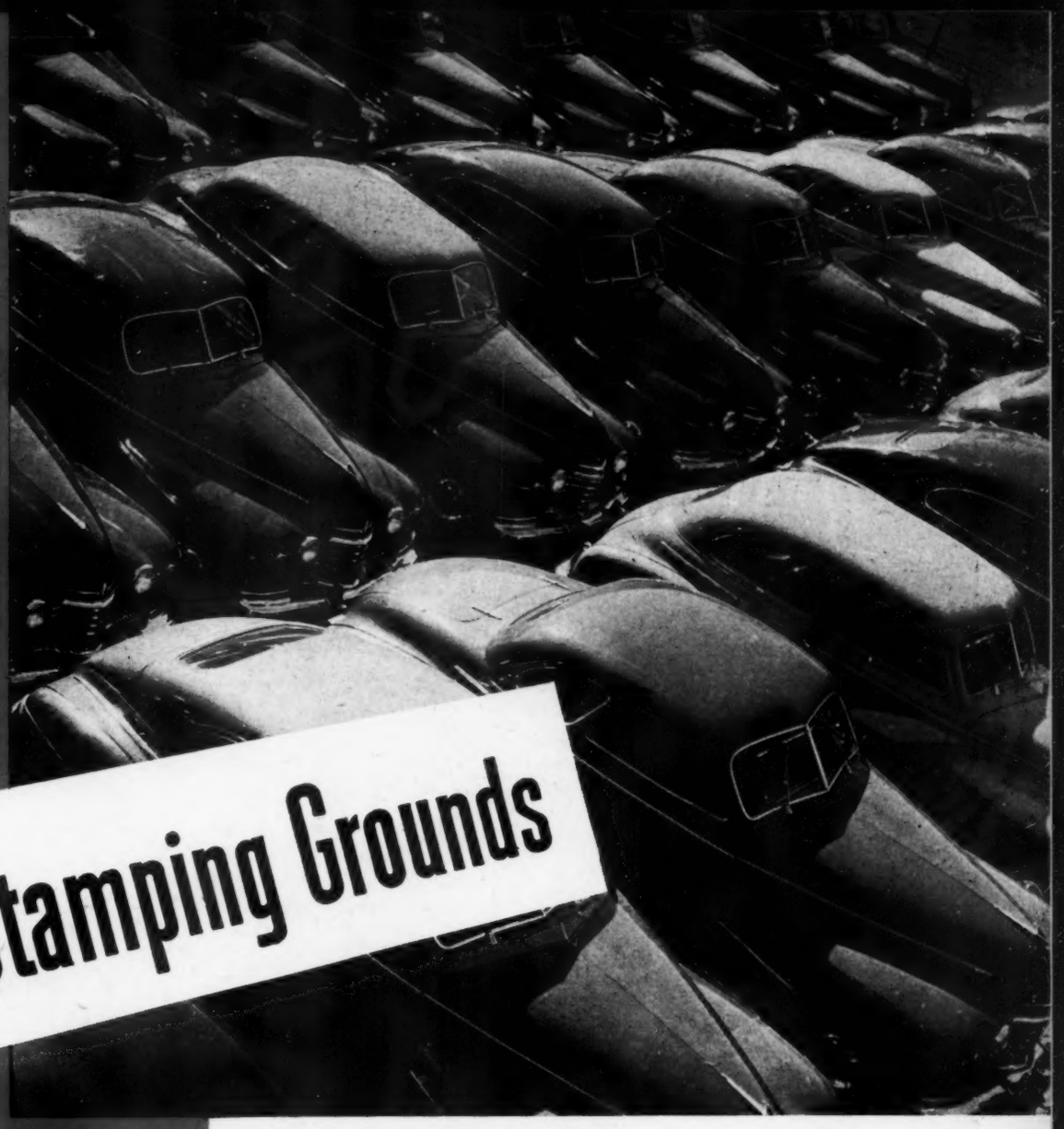
This ACME Ram Type Turret Lathe as illustrated is tooled for chucking work. It is also equipped with chasing attachment for cutting from 4 to 32 threads per inch. This attachment is extra and furnished only when required.

This type machine when fitted with automatic chuck and power screw bar feed will accommodate round bar stock up to 2" on the No. 5R machine and up to 2½" round stock on the No. 6R machine.

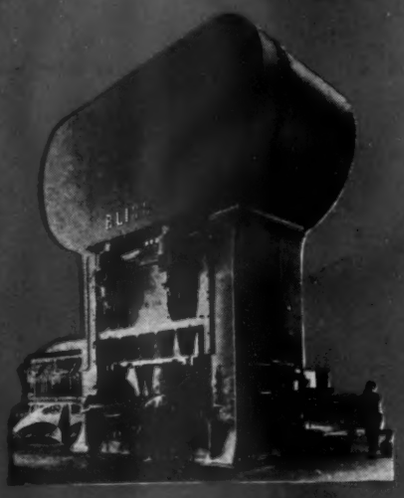
All of the most important features necessary to maintain accuracy and speed at low cost are incorporated in this design.

For further information contact our engineering department. Write for Bulletin G107A.

The ACME MACHINE TOOL Co.
CINCINNATI 32, OHIO



Bliss' Stamping Grounds



FORMING AUTOMOBILE SIDE PANELS in a Bliss 800 ton, triple-action press. Complete top of car is stamped in one stroke of similar Bliss press of larger capacity.

DO YOU REALIZE that fully half the total weight of your car is made up of parts produced by power presses?

It's a fact. And a further fact is that *only* Bliss builds the complete range of mechanical and hydraulic presses necessary to blank, form or draw all of the diversified sizes and shapes which merge into America's symbol of mass-production supremacy—from the one-piece turret top to the smallest stamping in the cigarette lighter.

Beginning with its cradling on down to this year's Golden Jubilee, the automotive industry has been the greatest of all "Bliss Stamping Grounds." It was the first to concentrate on the power press as an indispensable tool for the low-cost production of parts requiring maximum strength, minimum weight and complete interchangeability. From those earliest days Bliss engineers have participated prominently in the development of motordom's pressed metal equipment and methods.

That's why you're buying more than just a press when you specify Bliss. You're assuring yourself of a fund of practical know-how unavailable anywhere else.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

WORKS AT: Brooklyn; Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; Paris, France • SALES OFFICES: Detroit; Brooklyn; Cleveland, Dayton, Toledo, Ohio; Lansing, Mich.; Chicago; Philadelphia; Rochester; New Haven; Boston; Toronto.

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BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY

GENERAL ELECTRIC Announces:

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COMPLETE ENCLOSURE FOR PROTECTION AGAINST DIRT, DUST, AND WEATHER

NEW

Totally Enclosed

TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

In 1940, G.E. introduced the Tri-Clad open motor—with emphasis on the feature that industry wanted most in a motor, *protection.* Since then, more Tri-Clads have gone into service than any other integral-horse-power motor.

Today, we are ready with a new line of Tri-Clad motors—*totally enclosed, fan-cooled motors*—built on Tri-Clad design principles in both standard and explosion-proof types.

We believe that these are industry's most dependable motors. They are designed specifically for use in many adverse atmospheres—in iron dust, outdoors, in hazardous areas, and chemical atmospheres. Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them economical motors for use on almost every job. *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

STANDARD G. & L. MACHINE AND ATTACHMENTS PLAY *Important Part*

IN NEW DIESEL ELECTRIC LOCOMOTIVE REPAIR PROGRAM

Numerous Repair Jobs Ordinarily Requiring Special Purpose Machines Now Are Handled Efficiently and Economically on a Giddings & Lewis Horizontal Boring Machine

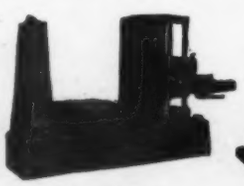
Confronted with the problem of repairing and reconditioning electric motor and diesel engine components, a large midwestern railroad uses a Giddings & Lewis machine to speed this work in its own shop. Instead of returning worn or damaged motor and engine parts to respective manufacturers for repair, thus extending locomotive out of service time, the repairs are made "on the spot" with minimum delay and handling.

Breakdowns vary to such an extent it is necessary to have a general purpose machine flexible enough to bore, drill, ream, tap, counterbore or perform any other similar machining operation. A standard G. & L. machine with standard attachments make all these operations possible. When the horizontal boring machine is not used for diesel electric locomotive repairs, it is profitably kept busy machining cross heads and axle housings, boring rods, turning flanges on odd shaped pipes, and many other operations on parts for steam locomotives.

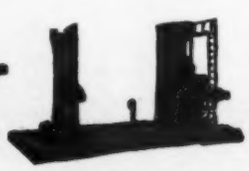
Alignment Easily Maintained on Typical Reboring Job

The cast steel motor housing is being rebored to receive the motor support journal bearings. When the power unit is in operation, vibration causes the housing to wear at bearing contact. As the wear increases, alignment of pinion and gear is impaired and then it becomes necessary to strip the motor housing and build up the worn surface by welding. After the fill is made, bearing caps are bolted into position and the two axles are bored simultaneously insuring accurate re-alignment. The number of repair jobs which can be machined on the G. & L. is determined largely by the imagination and ingenuity of the machine operator.

The general purpose Giddings & Lewis horizontal boring, drilling, and milling machine is well adapted to countless railroad machining jobs. G. & L. engineers will gladly advise and recommend the correct size machine and attachments for your shop, roundhouse or backshop needs.

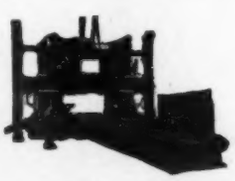


G. & L. Table Type Machine



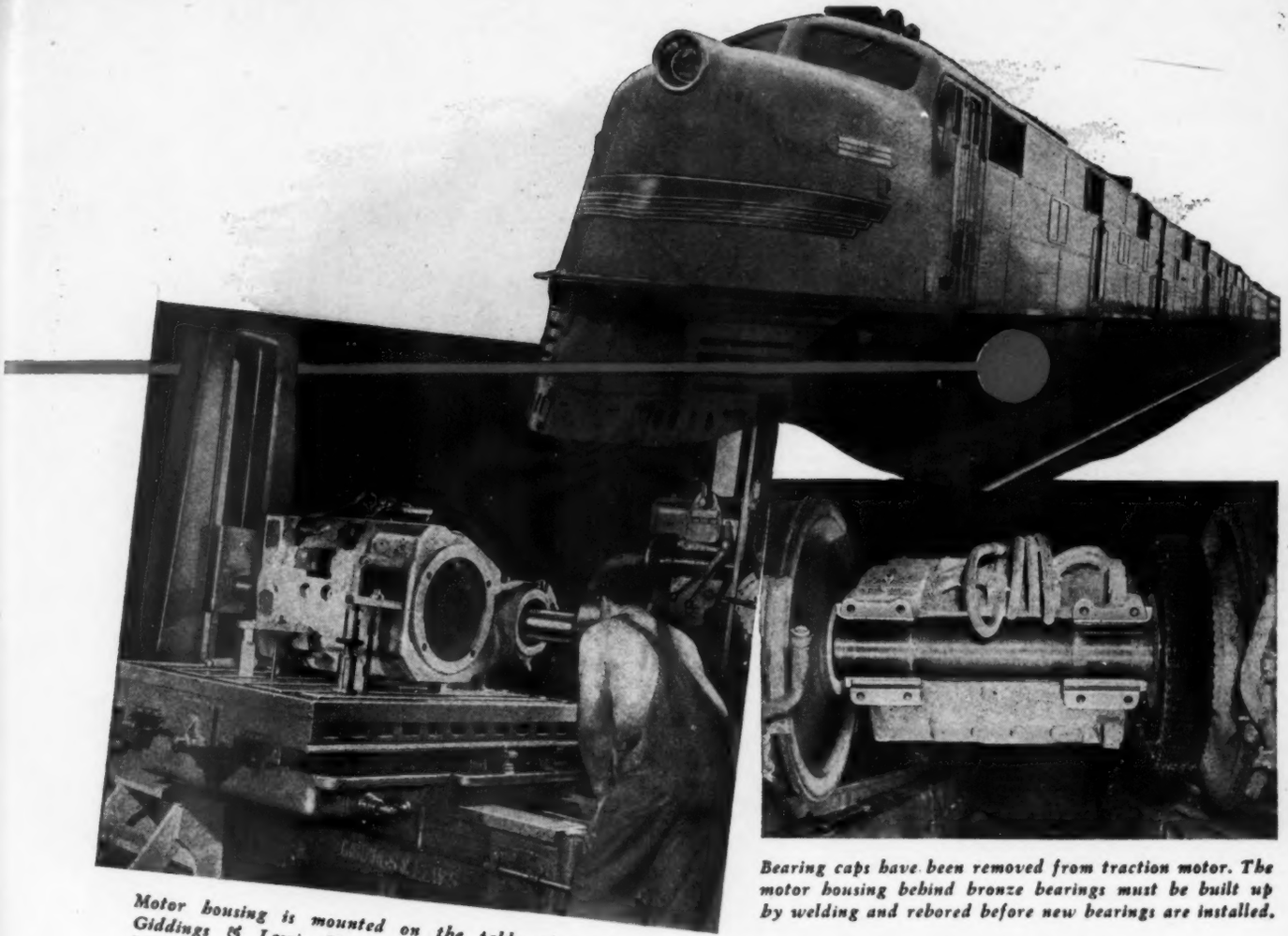
G. & L. Floor Type Machine

G. & L. Planer Type Machine



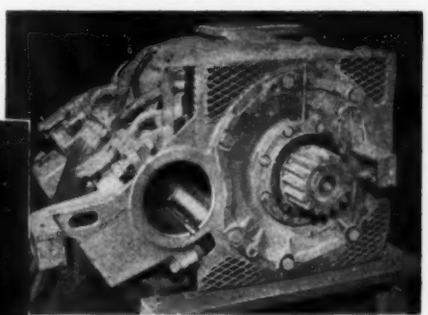
G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.

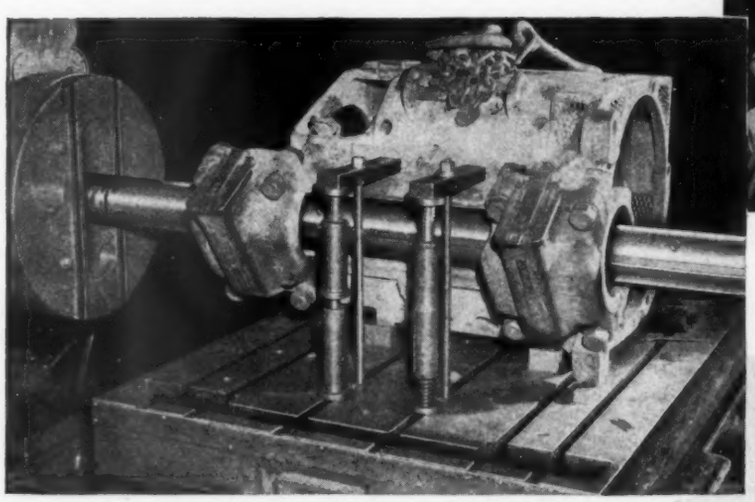


Motor housing is mounted on the table of a 350-T Giddings & Lewis Horizontal Boring Machine. Two boring cuts are made simultaneously.

Bearing caps have been removed from traction motor. The motor housing behind bronze bearings must be built up by welding and rebored before new bearings are installed.



Single traction motor unit of a gas electric motor car. Motor support bearing housings have been rebored to receive split bronze bearings.



Motor housing in the process of being rebored. Two cutters are used to speed this operation. Full support of boring bar between machine headstock and end support column insures accurate bore alignment.

New

Complete Information

FREE Descriptive of Giddings & Lewis machines and attachments for men interested in increasing work output. Write for this literature now—ask for Bulletin AM 66.

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We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

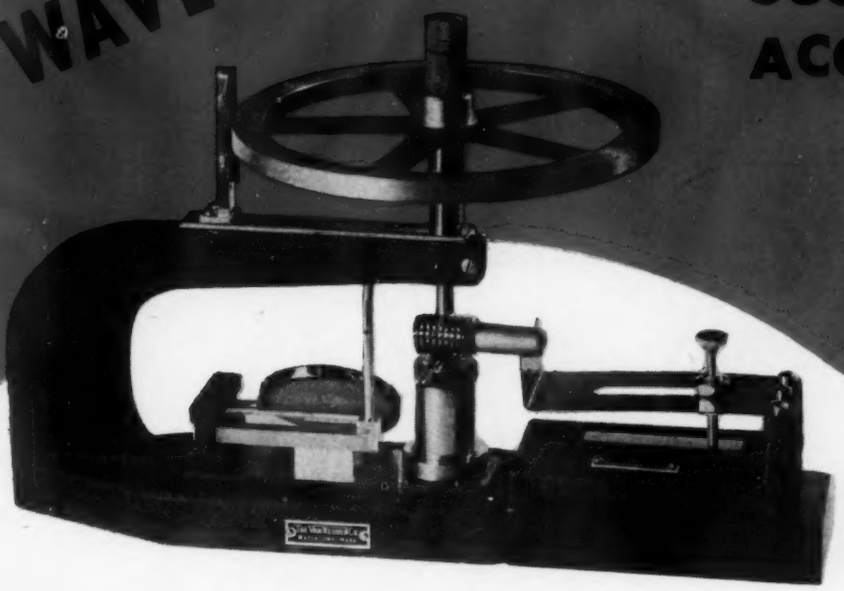
James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

Van Keuren LIGHT WAVE MICROMETER for SUSTAINED ACCURACY



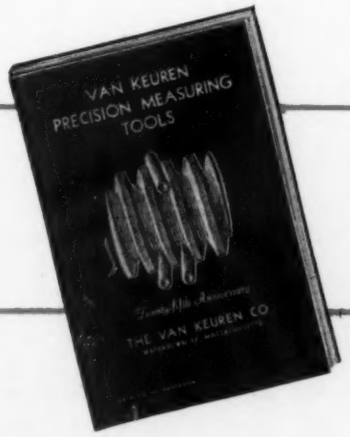
NEW SYSTEM OF ACCURACY—The Van Keuren light wave micrometer is an instrument which has formed the basis for an entirely new method of maintaining high standards of accuracy. No gage blocks are required. Errors from worn gage blocks will not be constantly duplicated in the product.

A calibration chart showing the micrometer screw corrections to .00001" is furnished with each instrument. The new type of hardened and ground precision micrometer screw actually improves with use. Fine workmanship and carboloy wearing surfaces make the instrument accurate and dependable for years of constant service.

CONTROLLED PRESSURE ASSURES UNIFORMITY—By using the sensitivity of light waves the light wave micrometer insures the exact duplication of measuring pressure by any operator. This controlled pressure feature makes it possible to measure hard or soft materials, and for readings to be duplicated by different operators to .00001".

IDEAL FOR SHOP MEASUREMENTS—The light wave micrometer is ideal for making measurements by the 3 wire method, for measuring plug gages, measuring wires, precision parts and shop standards. It is a reference instrument. Forget about comparative measurements with gage blocks—use the light wave micrometer. It is fast, accurate and profitable.

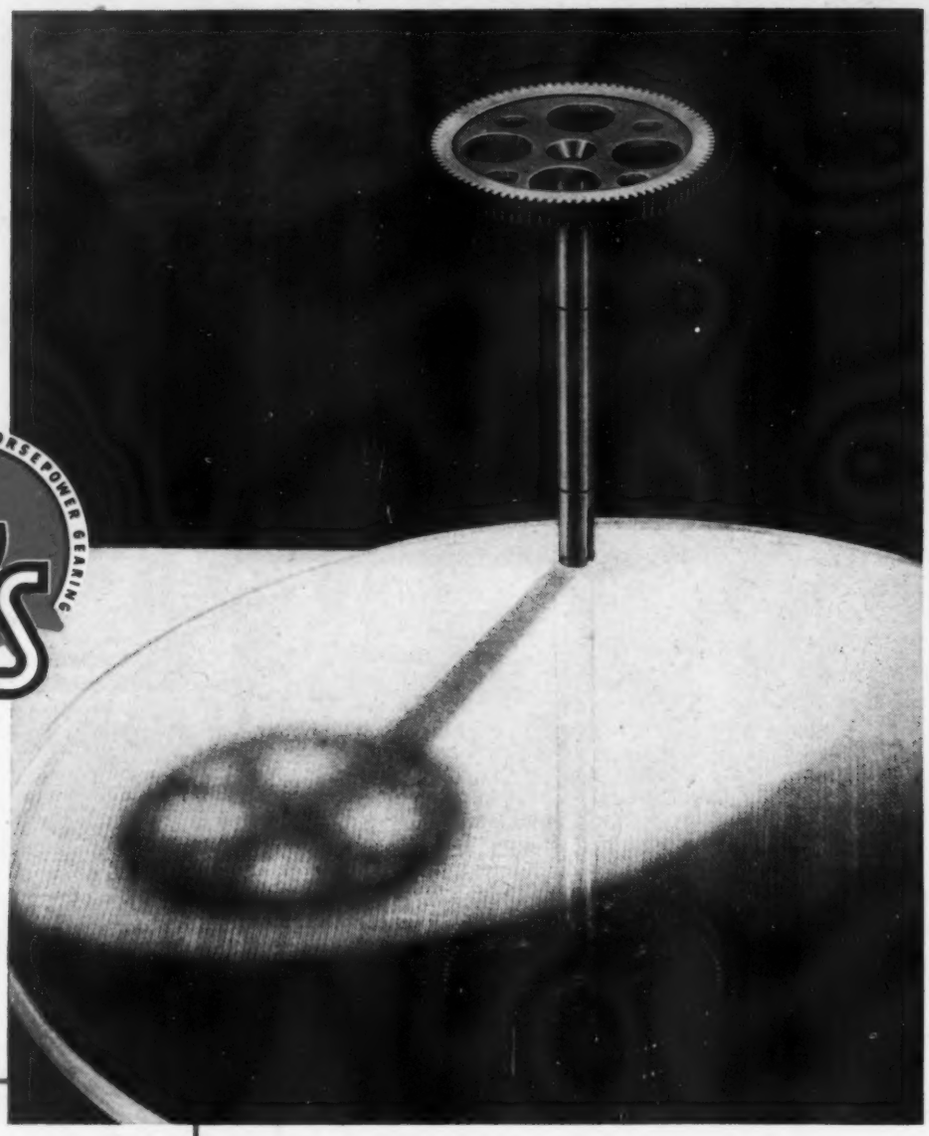
The Van Keuren light wave micrometer is described in catalog No. 33. This book also gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. *Write for your copy!*



THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.



Precision is Measured by Finest Fractions

● Every gage or measuring device known to the science of small gear production is employed in the manufacture and inspection of G.S. small gears. In fact, so precise are the manufacturing standards established in our plant, that rejections have been reduced to the vanishing point. Devices and equipment in which G.S. Fractional Horsepower Gears are used function more smoothly, quietly and dependably. If the quantity production of *better, more uniform* custom-made small gears is a matter of interest to you, won't you share your problems with a highly trained specialist in this field . . a G.S. engineer?

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

THE METHOD OF LOW-COST PRODUCTION

Possible only by Contour Sawing—*world's fastest metal-removing process.* No other machine process can do this.

Exclusive features of Contour Sawing: 1—It is modern industry's shortcut around complex, time-taking setups. 2—Cutting tool leaves only a 1/16" slot—does not reduce to worthless chips the metal that it removes. 3—Cutting is continuous by hundreds of sharp, hard tool points on a band—there is no backstroke or lost motion. 4—Only a short training period required—not years of experience.

Like this brake lever made by Wincharger Corporation of Sioux City, Iowa, countless jobs formerly requiring castings wer slow, expensive. Now Contour Sawing cuts them from stock with ease, speed and economy—all materials, even carbon and tough alloy steels, a foot or more thick.

Write for booklet *"DoALL Equals Ten Plus"* which compares Contour Sawing with ten other machine methods. It is distributed free to requests under company letterheads.

The DoALL *Company*

DoALL STORES IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION MINNEAPOLIS 4, MINN.

ALL THIS *and*

PRECISION *too*

BALL TURNING

SPIRAL CUTTING

MILLING

GRINDING

MULTIPLE OPERATIONS

RELIEVING

SLOTTING

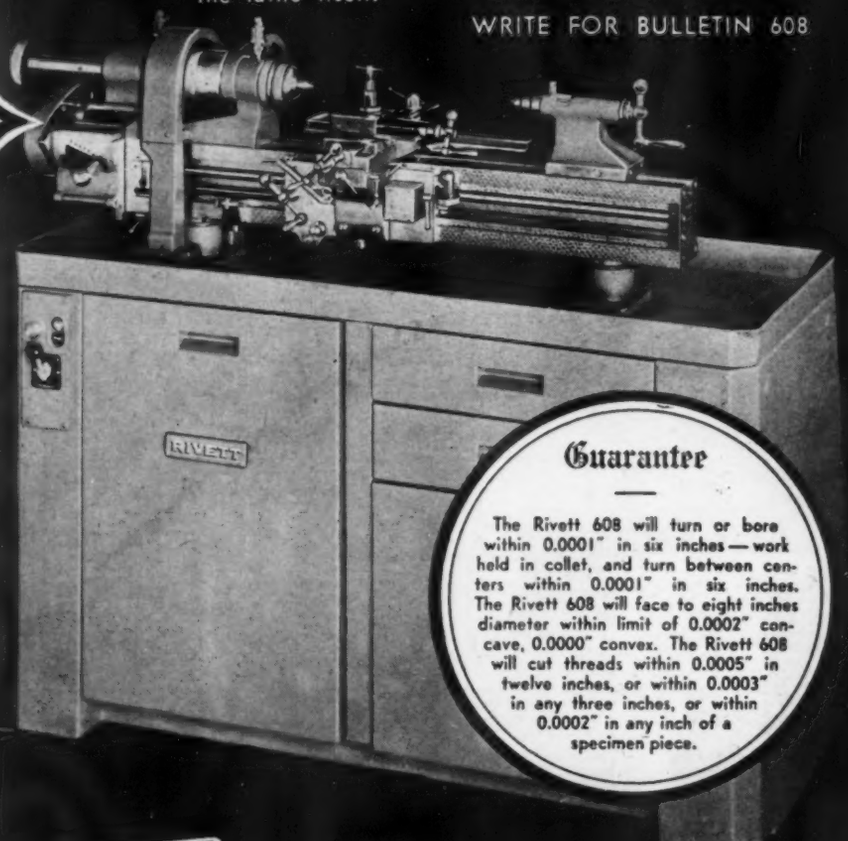
FORMING

TAPER TURNING

All possible through precision-made attachments.

No. 608 back-geared, screw cutting, bench lathe for tool making and instrument shops where handling of a greater variety of jobs in minimum time is important. This small but exceedingly proficient lathe with slide areas equal to that of one twice its size permits the operator to finish his work completely without employing other machines, and, throughout the entire series of operations, utilize the inherent precision of the lathe itself.

WRITE FOR BULLETIN 608



Guarantee

The Rivett 608 will turn or bore within 0.0001" in six inches — work held in collet, and turn between centers within 0.0001" in six inches. The Rivett 608 will face to eight inches diameter within limit of 0.0002" concave, 0.0000" convex. The Rivett 608 will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U.S.A.

ARMY E NAVY

WITH STEEL GAGES-GAGE LIFE WAS 24 HOURS *Yesterday*

Today—

GAGE LIFE IS *8 months* WITH
NORBIDE GAGES

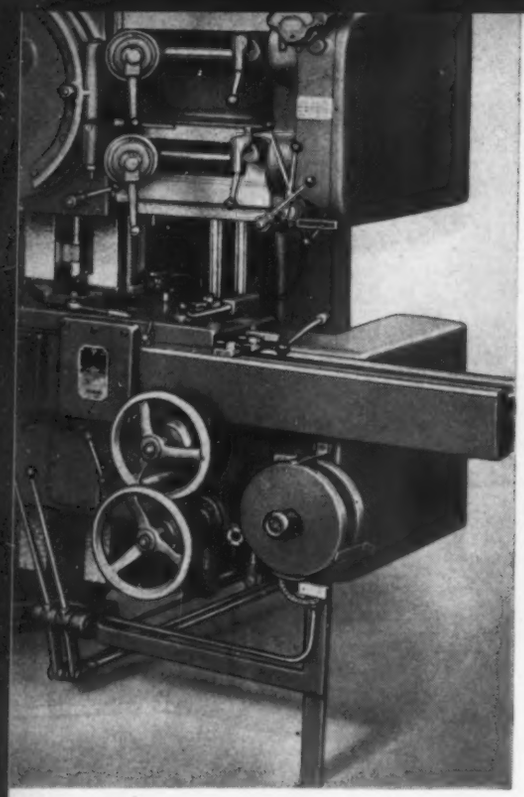
This NORBIDE Plug Gage gave eight months service where previously one steel gage was worn out every day. This gage was used on a grinding job on an internal grinder where the work was checked on the machine. The NORBIDE gage replaced at least 160 steel gages and therefore enabled the plant to save about $1700.00 over the eight months period.

Because Norton Boron Carbide is the hardest material made for commercial use NORBIDE Gages outwear conventional types of measuring devices 150 times and more. In addition to their great wear resistance, NORBIDE Gages will not pick up lint nor become charged with particles of metal and they are inert to chemicals employed where gages are used.

Ask your regular Supplier about NORBIDE Gages. Or for additional information write to—

NORTON COMPANY **WORCESTER 6, MASS.**

NORBIDE - The Hardest Material Made by Man
REGISTERED TRADE-MARK



KING

VERTICAL BORING AND TURNING MACHINES

● Here is the first in a new series of King Vertical Boring and Turning Machines. It has not only been improved in appearance but is of heavier construction throughout.

A ten percent increase in weight, new massive ram heads, a wider range of speeds assures a rigid, accurate machine particularly adaptable to the use of carbide tools.

The protecting enclosures for cross brace mechanism—the fully enclosed feed boxes on the rail, heavy tie plate across the swivels are but a few of the many improvements that help its appearance and add to its serviceability.

With the D.C., Adjustable Speed motor drive, the machine provides an unusually wide selection of table speeds with a minimum of gear changes—ratio of speeds 45 to 1. Since the table speed changes are accomplished without stopping the table, this is an important feature from the standpoint of increased production and lower costs.

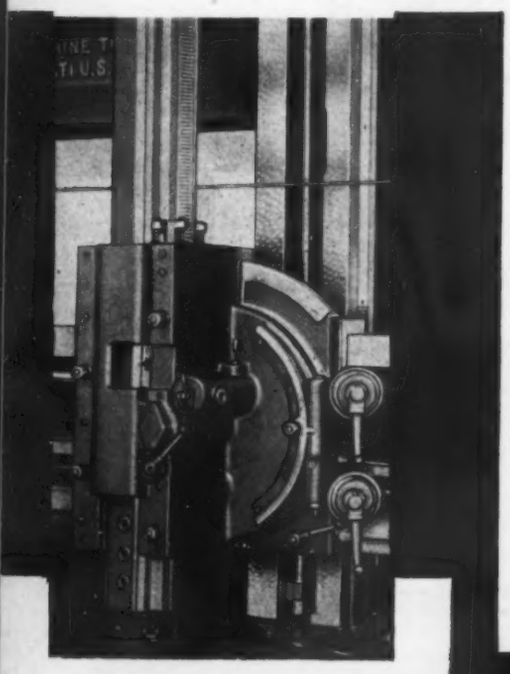
Where D.C. current is not available, a motor generator set can be furnished to obtain the same ratio of speeds. The machine can also be equipped with constant speed motor drive and fixed speed increments.

Here is a modern machine of improvd appearance—of clean cut design, with emphasis placed on increased production through simplified operation, and better, more accurate production through sound mechanical improvements and greater rigidity.

The new series of King Vertical Boring and Turning Machines include ten sizes: Single Column Type—30", 36", 42". Double Column Type—52", 62", 72", 84", 100", 120", 144".

CONTROLS

● Increased accessibility of controls is obtained by locating all levers to the front of the machine within convenient reach of the operator. Angular Hand Adjustment Levers with micrometer dials for vertical and horizontal movement of head are an integral part of the head and move with it. This permits on-the-spot adjustment—saves time and aids production. Directional operating handles add to ease of operation. Limit stops are provided at end of rail.

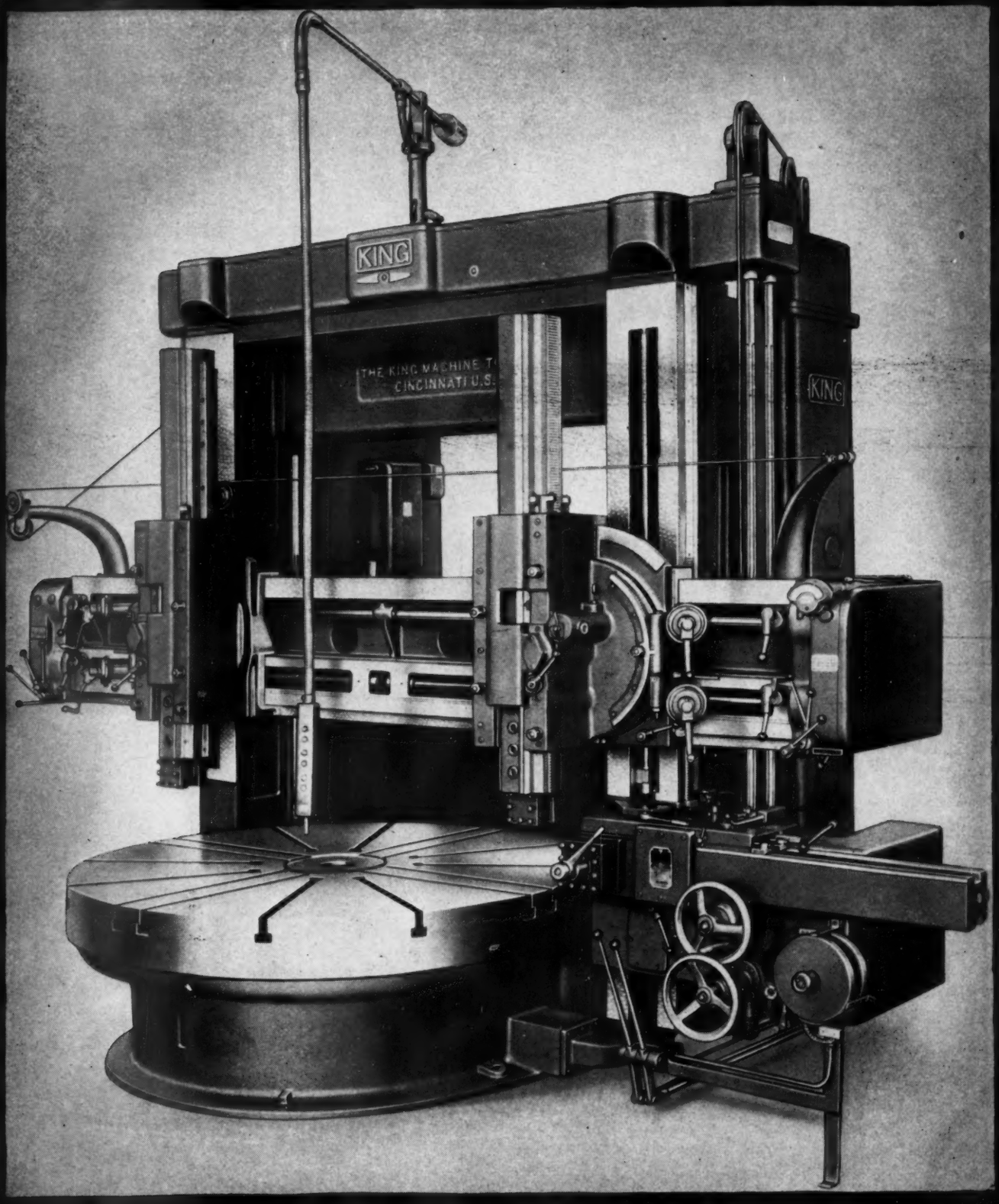


HEAD The new, powerful, extremely accurate rectangular type ram head with four gibs and eight bearing surfaces assures longer wear and provides the greater rigidity required for best results with carbide tools.

PENDANT Centralized table control is accomplished through a conveniently located pendant switch easily adjusted to operating height and position. In addition to table, pendant switch can be arranged to include control for rapid traversing, rail elevating, and other unit control.

THE KING M

N A NEW SERIES OF



MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

What size is this Socket Screw?

EXPERIENCED MEN GUESSED WRONG 50% OF THE TIME!
Tests have shown that even experienced men have guessed wrong on size and thread pitch of socket head cap screws 50% of the time.

SINCE THEY CAN'T BE SURE, *your assembly workers must take time to find out – time for "miking" and gauging to check the size – time for tedious sorting when screws get mixed up.*

There's No Guessing when it's Size-Marked!

On the heads of P-K Socket Head Cap Screws, the size is clearly marked – seen at a glance.

THERE'S NO TIME WASTED –

AT THE TOOL CRIB – Left-over, mixed up screws are quickly replaced in the right box or bins, without slow "miking" or gauging.

AT THE JOB – Assemblers work faster – take no time out "going back" to replace a size issued incorrectly.

TRAINING NEW HELP – Even new assembly workers can be trusted with P-K Size-Marked Socket Screws – make no costly errors.

BY MAINTENANCE MEN – Your customer's repairmen will appreciate the Size-Mark in disassembly and reassembly. It gives your product an extra sales feature.

Plus GEAR GRIP*

With Gear Grip, which prevents slipping and fumbling, the Size-Mark gives P-K Socket Head Cap Screws a double feature that puts them years ahead in utility and performance.

*U. S. Pat. No. 126,409

Only PARKER-KALON offers Socket Head Cap Screws with SIZE-MARK and GEAR GRIP

Another P-K Plus Value!

GROUND THREAD SOCKET SET SCREWS

Thread grinding provides a smooth, bright, gleaming finish that has none of the nicks, burrs, tool marks, hardening scale, or imperfections common to ordinary cut thread set screws. Made from hardened stock, with the characteristic smoothness of a ground finish, these screws are as different from ordinary set screws as night and day!

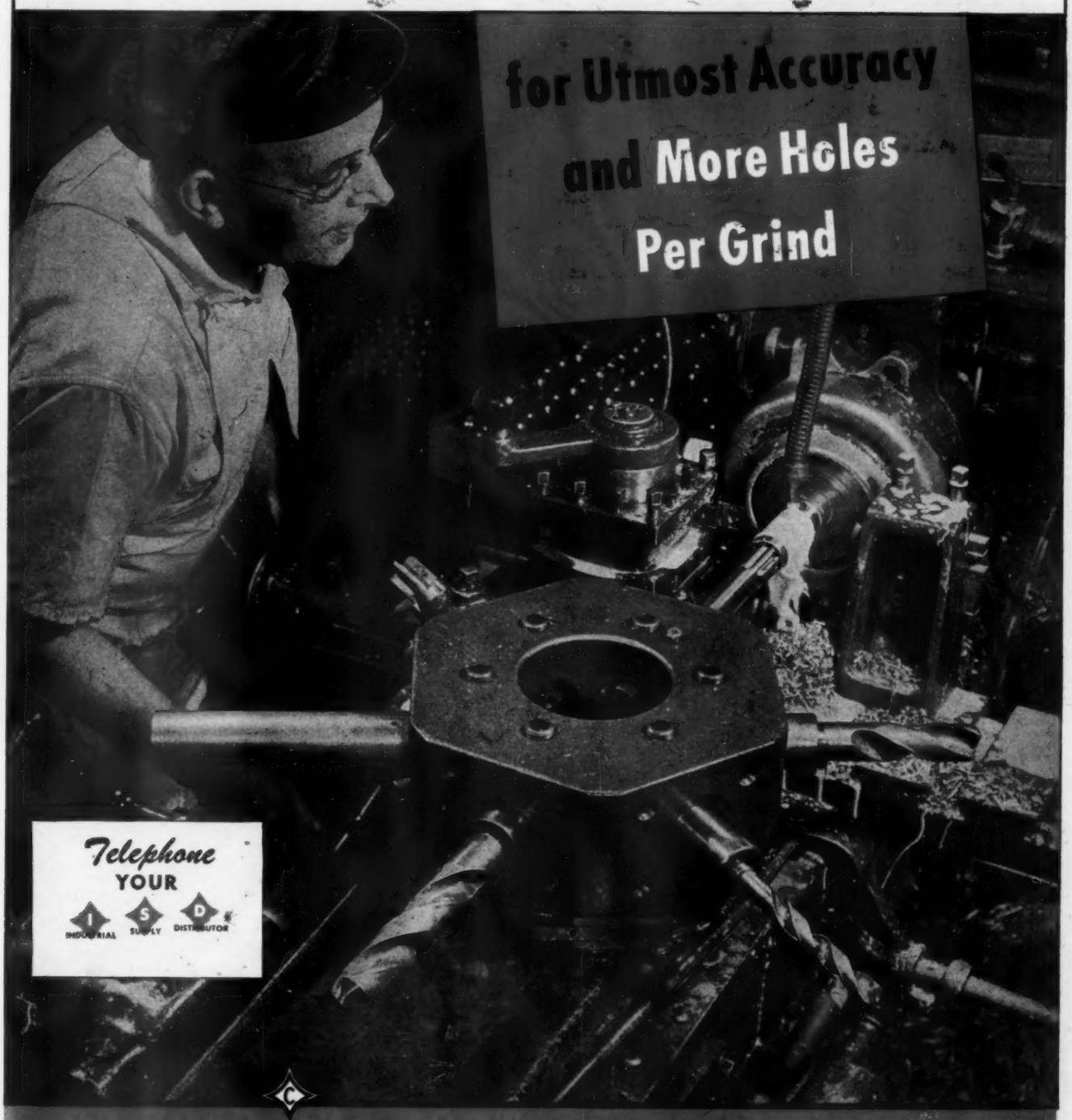
Seeing is Believing!

Send for this unique SAMPLE KIT. Compare. You'll agree your assemblies deserve the many advantages of these 3 extraordinary P-K improvements. Write today! Parker-Kalon Corp., 200 Varick St., New York 14.

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS

PARKER-KALON *Cold-forged* **SOCKET SCREWS**

CLEVELAND Drills and Reamers



The CLEVELAND TWIST DRILL COMPANY
1243 EAST 49TH STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

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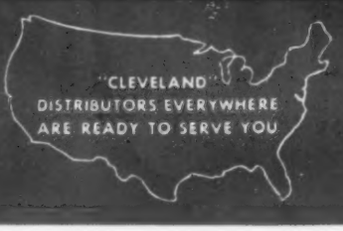
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 3, ENGLAND



For Higher Standards of Craftsmanship

A full line of standard tools and gages for regular production.
Specials designed or made up to order.
Send for catalog today.

METRO TOOL AND GAGE CO.
4240 Peterson Avenue
Chicago 30, Illinois

PHOTO. COURTESY OF GILBERT and BARKER MFG.

At his finger-tips . . THREADING PERFORMANCE

This is a simple, rugged tool. It has taken the headaches out of internal threading in hundreds of plants. It is a Geometric "Class S" Collapsing Tap (the type shown above is for stationary use, has a plate trip and is reset by the conveniently placed handle). The "Class S" Tap is suitable for stationary and rotary use and is convertible into different types of trip. In addition Geometric "Class S" Taps can be used on almost any machine and for nearly every threading job over $1\frac{1}{4}''$ in diameter. Their reputation is built on their unequalled record of threading performance in leading plants throughout the world.

FOR NEARLY EVERY THREADING JOB — A GEOMETRIC!

If you have in mind a particular threading problem, we will be glad to have our engineers give you their recommendations, based on over a half century of specialization in this field. Why not let us send you the latest Geometric catalog?

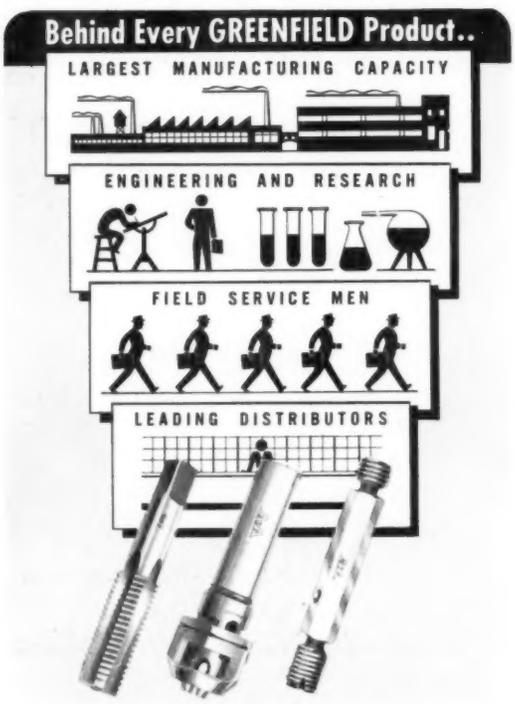
THE
GEOMETRIC
TOOL COMPANY . . NEW HAVEN 15, CONN.
A Division of Greenfield Tap and Die Corporation

REPRODUCED FROM AN ORIGINAL KODA

When the tap's in the fire . . .

This "Greenfield" man is measuring heat with as much precision as though he was using a micrometer to measure size. He is using an optical pyrometer. On his technical skill depends to a large degree the performance of the finished product in your plant. Improved furnaces, precise heat measuring devices, and the continuing accumulation of "know-how" have made the heat treating of tool steels an exact science in "Greenfield" plants.

It is a science that contributes much toward your getting ***more for your money*** when you use "Greenfield" tools and "Greenfield's" "Show-How" field service.



GTD GEOMETRIC

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

FOR ADAPTABILITY PUT IT ON THE BLANCHARD

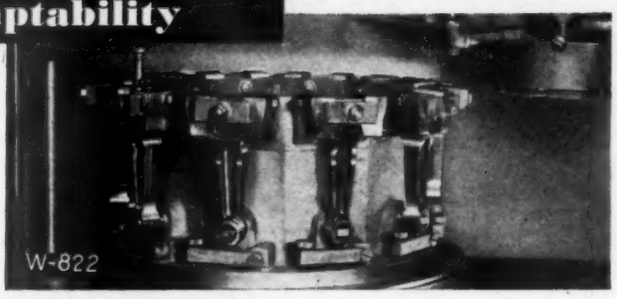
Adaptability

This picture clearly demonstrates the adaptability of the Blanchard. Here are a variety of pieces of cast iron, steel, and bronze ready to be ground on the No. 18 Blanchard Surface Grinder. Most of the pieces are to be ground on two sides, the usual limits being ±.0005" and the amount of stock removed from .015" to .020" per surface.

Adaptability

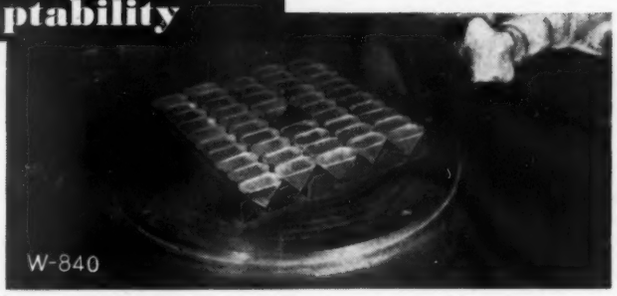
In adapting this work to the grinder, a Blanchard designed fixture holds ten pieces on the chuck at one time. These housing poles for magnetos have .140" stock to remove from steel laminations, and 30 pieces are finished per hour. This job also demonstrates Blanchard's ability to carry through from roughing to finishing operation.

Adaptability



This is an excellent example of increased production through adaptability. Formerly these master rods for an 1830 H.P. radial engine were milled and finish-ground one at a time at the rate of 15 to 20 minutes each. Now they are ground 10 at a time in a Blanchard special fixture on the No. 18 Blanchard Surface Grinder, which removes 3/8" of metal and turns them out finished at the rate of four minutes each.

Adaptability



The versatility of a Blanchard Grinder is well demonstrated in the adaptability of Blanchard No. 11 Surface Grinder. The illustration directly opposite shows a special fixture load of 48 glass prisms ready for grinding the hypotenuse. The "V" block fixture is held magnetically on the chuck. Grinding time is less than 3 minutes and stock removal .085".

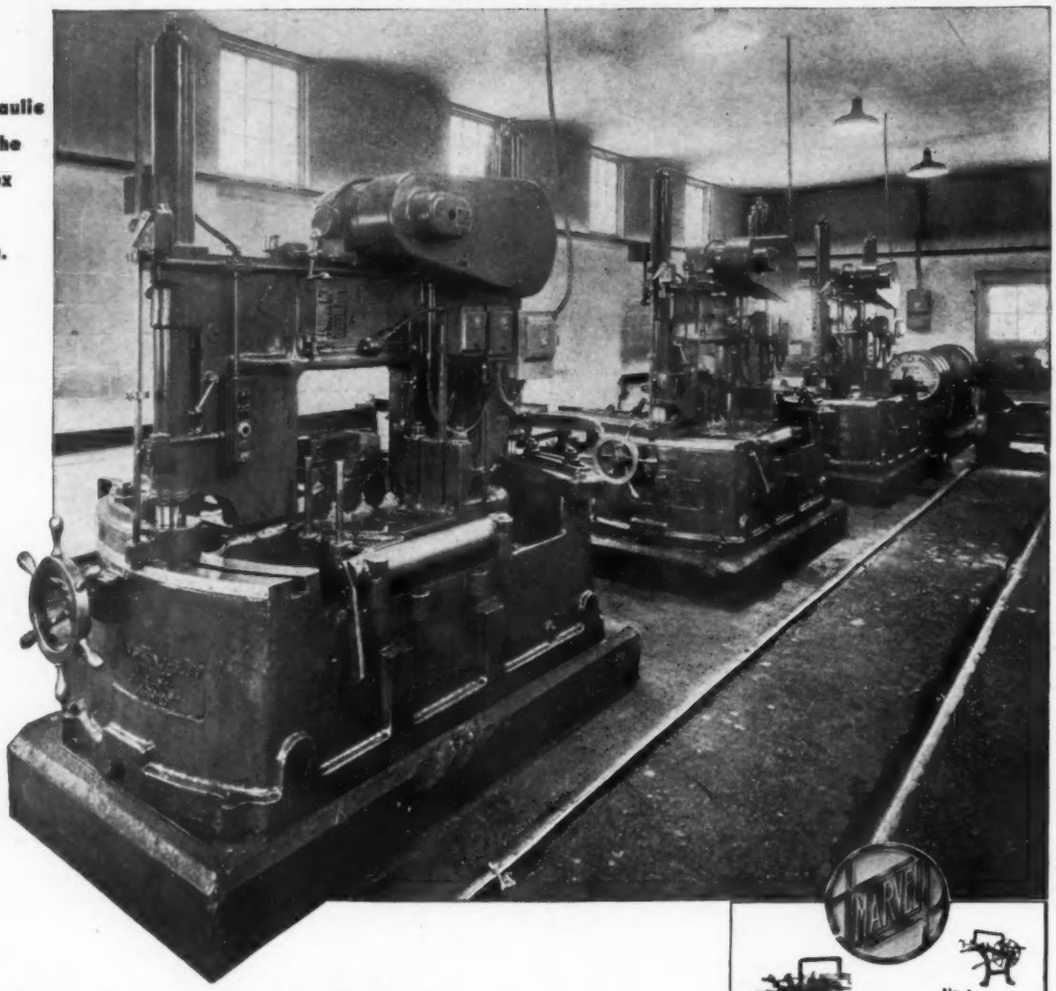
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

3 MARVEL $18 Hydraulic Hack Saws at the Babcock & Wilcox Tube Co.— Beaver Falls, Pa.



EASILY CUT-OFF TOUGHEST STEELS

Steels just don't come too tough for MARVEL Giant Hydraulic Hack Saws. Take, for example, the three No. 18 MARVEL Saws, at the Babcock & Wilcox steel mill, shown above. These machines are used to cut test specimens from sample pieces of stainless and other tough alloy billets which are checked for seams, pipes, etc., before being drawn into tubing. It takes tough steel to make the best tubing, and it takes modern sawing equipment to cut it rapidly, accurately and economically.

With 10 types of metal-cutting saws, each available in a series of variations, MARVEL can furnish sawing machines that exactly meet your requirements. If you have a metal-sawing problem—call in the local MARVEL Sawing Engineer.

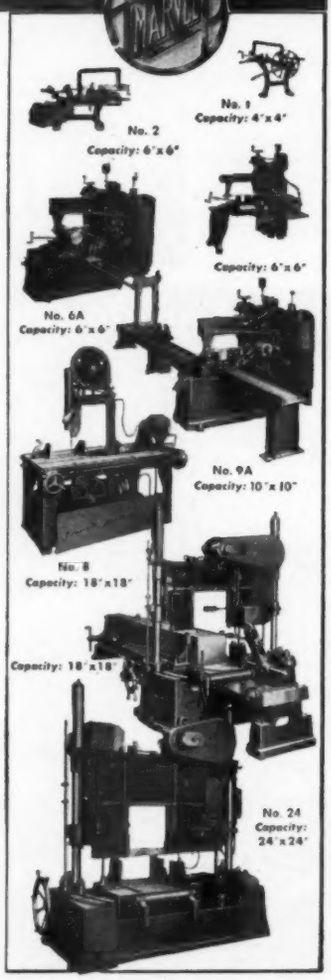
Write for MARVEL Catalog or check it in your Sweet's Catalog Files

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE **CHICAGO 39, U. S. A.**

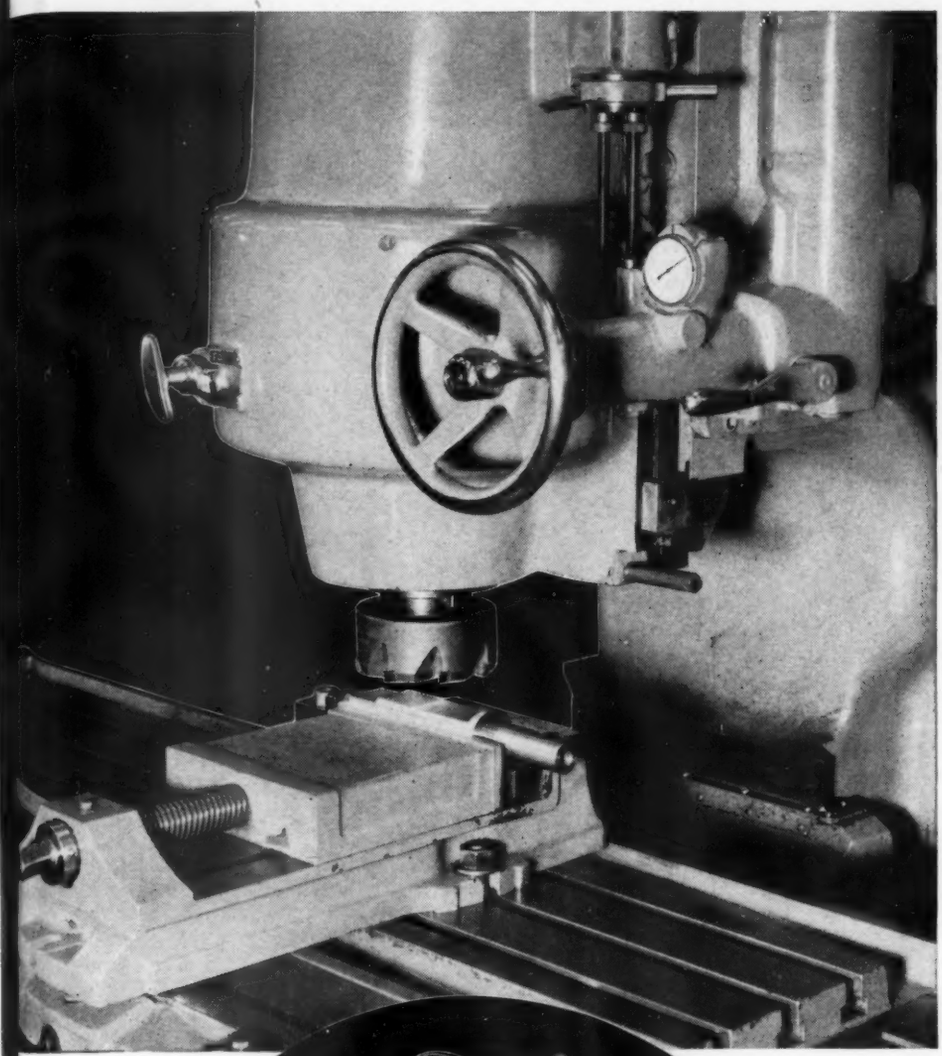
Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.



MARVEL SAWS

STAINLESS STEEL MILLING

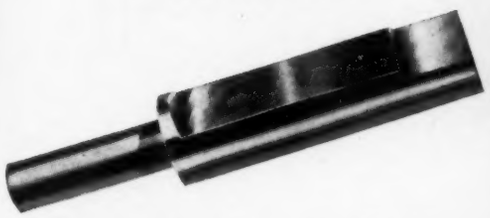
Made easy on a Kearney & Trecker CSM



THE JOB

Stainless steel is difficult to mill under almost any circumstances—but this super-powered CSM, equipped with the proper cutter literally "walked through" this job.

OPERATION:	**Rough Mill Stud**
MATERIAL:	**Stainless Steel**
CUTTER:	**6" Dia.; 8 Tooth**
TABLE FEED:	**21 IPM**
SURFACE SPEED:	**346 SFM**
DEPTH OF CUT:	**.441" (Max.)**
FEED PER TOOTH:	**.020"**
MILLING TIME:	**26 Seconds**



STAINLESS STEEL STUD

Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

• • •

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analyses of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

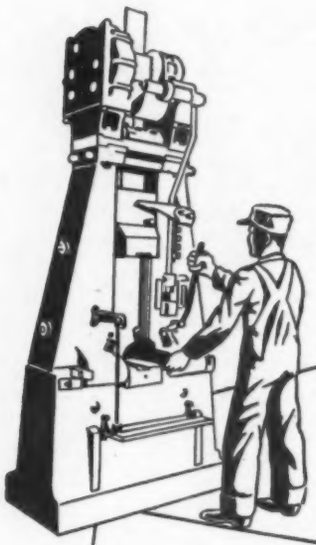
30 HP Plain CSM

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

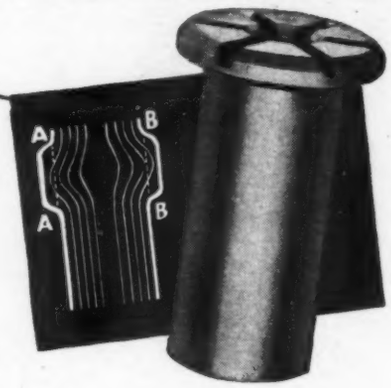
BE READY FOR TOMORROW . . . WITH CSM'S

YOU GET CORROSION RESISTANCE PLUS



LOWER UNIT COSTS. This aircraft fuel supply valve body was forged from Carpenter *Stainless No. 8* (*Type 303*) forging bars. Our *machine-turned* billets, from which all Carpenter forging bars are rolled, provided freedom from injurious surface defects, reducing rejects to a minimum. The corrosion resistant properties of Stainless No. 8 licked the danger of "valve sticking" from high octane gas.

LONGER LIFE. In spite of tremendous pressures and highly abrasive conditions in service—forged knuckle pins like this stay on the job longer because they are made from Carpenter Stainless. And note in the diagram that forging produced an even grain flow throughout, thus strengthening the thin sections at points AA and BB.



POSITIVE PROTECTION against corrosion to withstand the effects of repeated sterilization plus the required strength and hardness, made Stainless a natural choice for these forged surgical instruments. Clean, flawless Carpenter Stainless forging bars reduced rejects, increased output.

ECONOMICAL, TROUBLE-FREE FORGINGS WITH *Carpenter* STAINLESS

If rejects run high when forging Stainless, it's time to check all along the line. Many factors must be controlled right in the forge shop. But to eliminate trouble and secure best results you must be sure that your forging bars are sound, clean and free from injurious surface defects. Such forging bars assure easiest forging operations and lowest production costs.

At Carpenter, Stainless Steels are made in a tool steel mill to tool steel quality standards. Stainless billets are disc-inspected to assure soundness and homogeneity—and are then *machine-turned* to remove all surface imperfections. By this painstaking process we end up with Stainless bars that, lot after lot, assure economical, trouble-free forgings.

You'll find your nearby Carpenter representative extremely helpful when it comes to finding ways and means of applying Stainless to your postwar products. Back of him stands a company with years of practical experience in solving Stainless problems. Call him in today or write us at the mill.

PUT THIS BOOK TO WORK! In addition to specific Stainless forging information, our 98-page book "Working Data for Carpenter Stainless Steels" shows you how to select and fabricate a wide variety of Stainless Steels. Be sure to get your copy! A note on your company letterhead, indicating your title is all that's necessary. Write today!

THE CARPENTER STEEL COMPANY • 109 W. Bern St., Reading, Pa.

GIVE YOUR PRODUCTS THESE EXTRA ADVANTAGES . . . With Carpenter Stainless

- Strength and Rigidity
- Heat Resistance
- Weight Saving
- Freedom from Rust
- No Plating to Peel
- Ease of Assembly
- Longer Product Life
- Sales Appeal

Carpenter STAINLESS STEELS

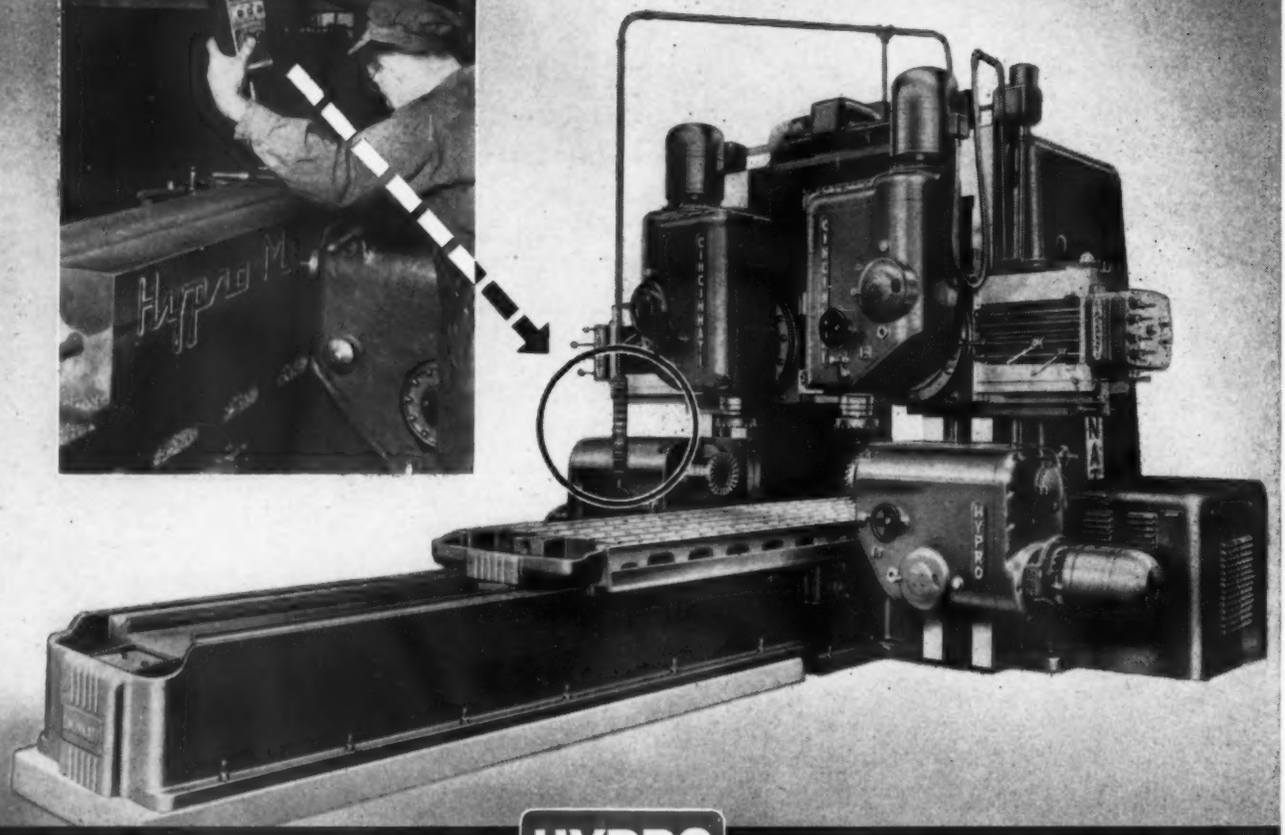
BRANCHES AT Buffalo, Chicago, Cincinnati, Cleveland, Dayton, Detroit, Hartford, Indianapolis, New York, Philadelphia, Providence, St. Louis

NOW COMPLETE FINGER-TIP CONTROL FROM PENDANT STATION...

Hypro-*electronic*

PLANER MILLER DRIVE

Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.

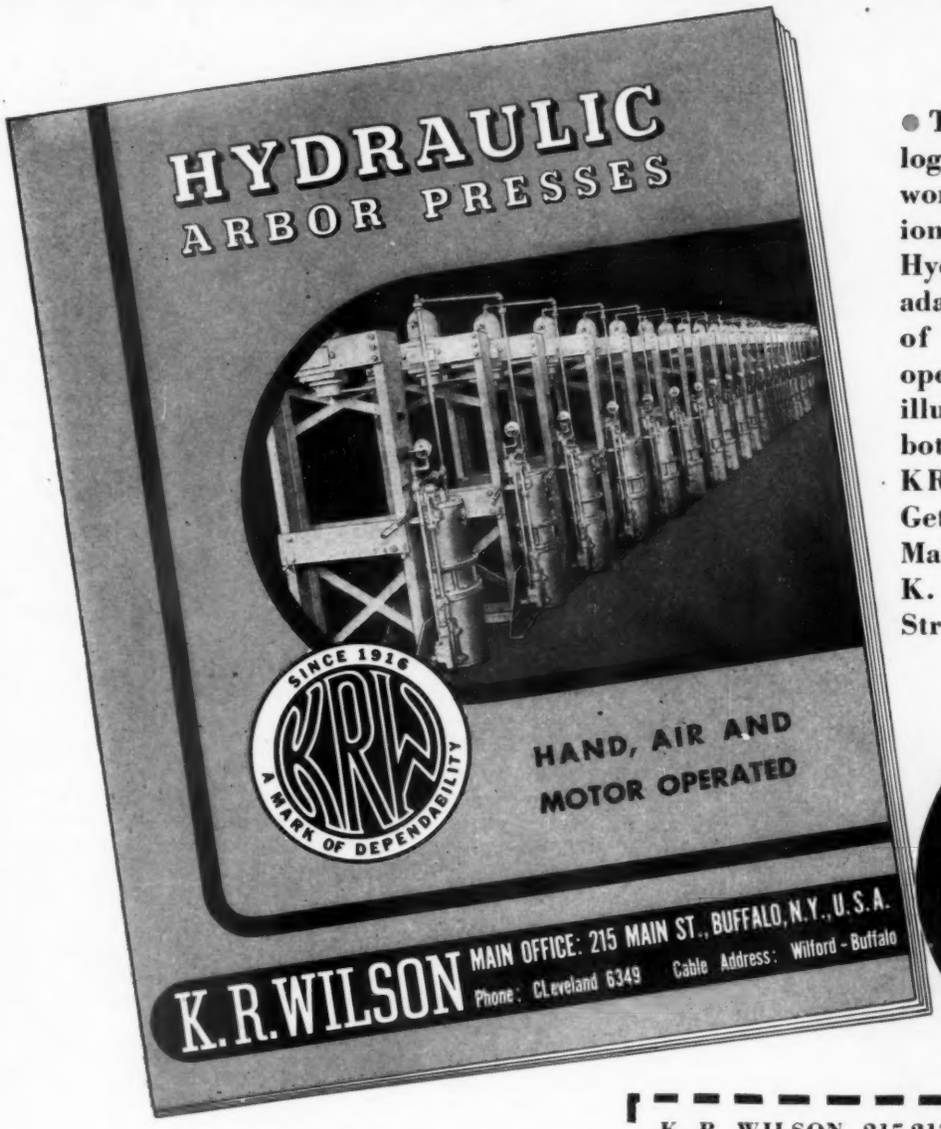


THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

NEW KRW HYDRAULIC PRESS BOOK of Profitable Production Ideas



● This is more than a catalog . . . it is a textbook of workable, practical suggestions on how low-cost KRW Hydraulic Presses can be adapted to solve a myriad of everyday production operations. 32 completely illustrated pages that show both standard and special KRW Presses in operation. Get your Free Copy now... Mail the coupon at once. K. R. Wilson, 215 Main Street, Buffalo 3, N. Y.

NOW AVAILABLE
AS
HAND OPERATED
ELECTRIC OPERATED
AIR OPERATED
Presses...

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K. R. WILSON, 215-217 Main Street, Buffalo 3, N. Y.
Please mail me a copy of your New
Hydraulic Arbor Press Catalog.

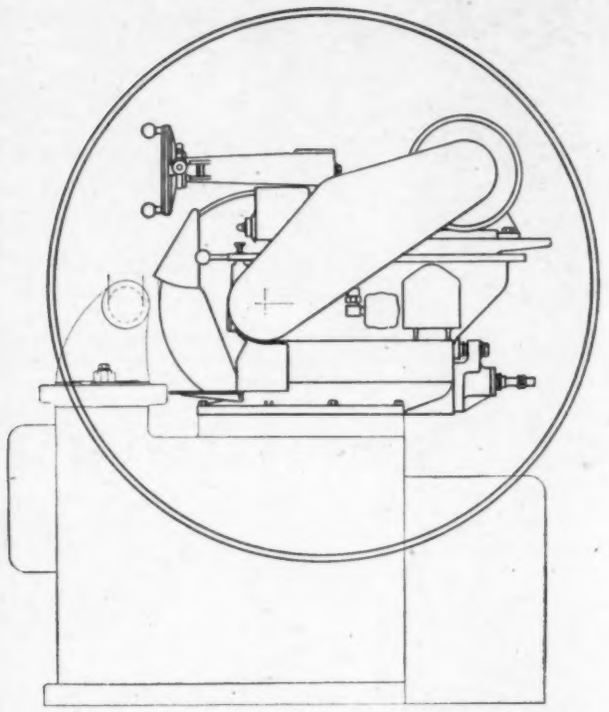
Name.....

Address.....

City & Zone..... *State*.....

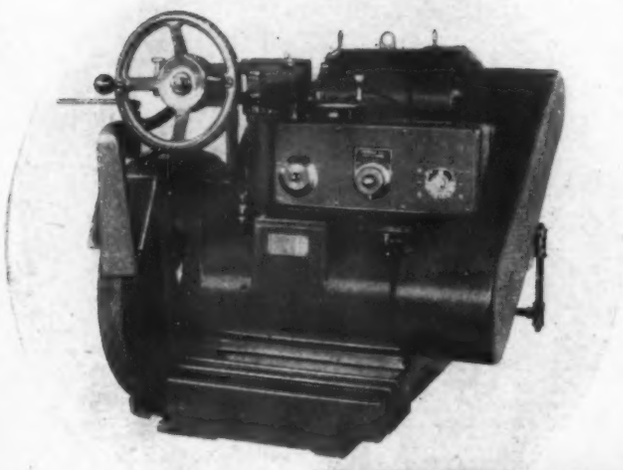
11

You too can have FITCHBURG *Automatic* PRECISION GRINDING *INEXPENSIVELY...*



FITCHBURG Bowgage Head mounted on another make of grinding machine

...by installing FITCHBURG Bowgage Heads on the Grinders you now have.



FITCHBURG BOWGAGE HEAD

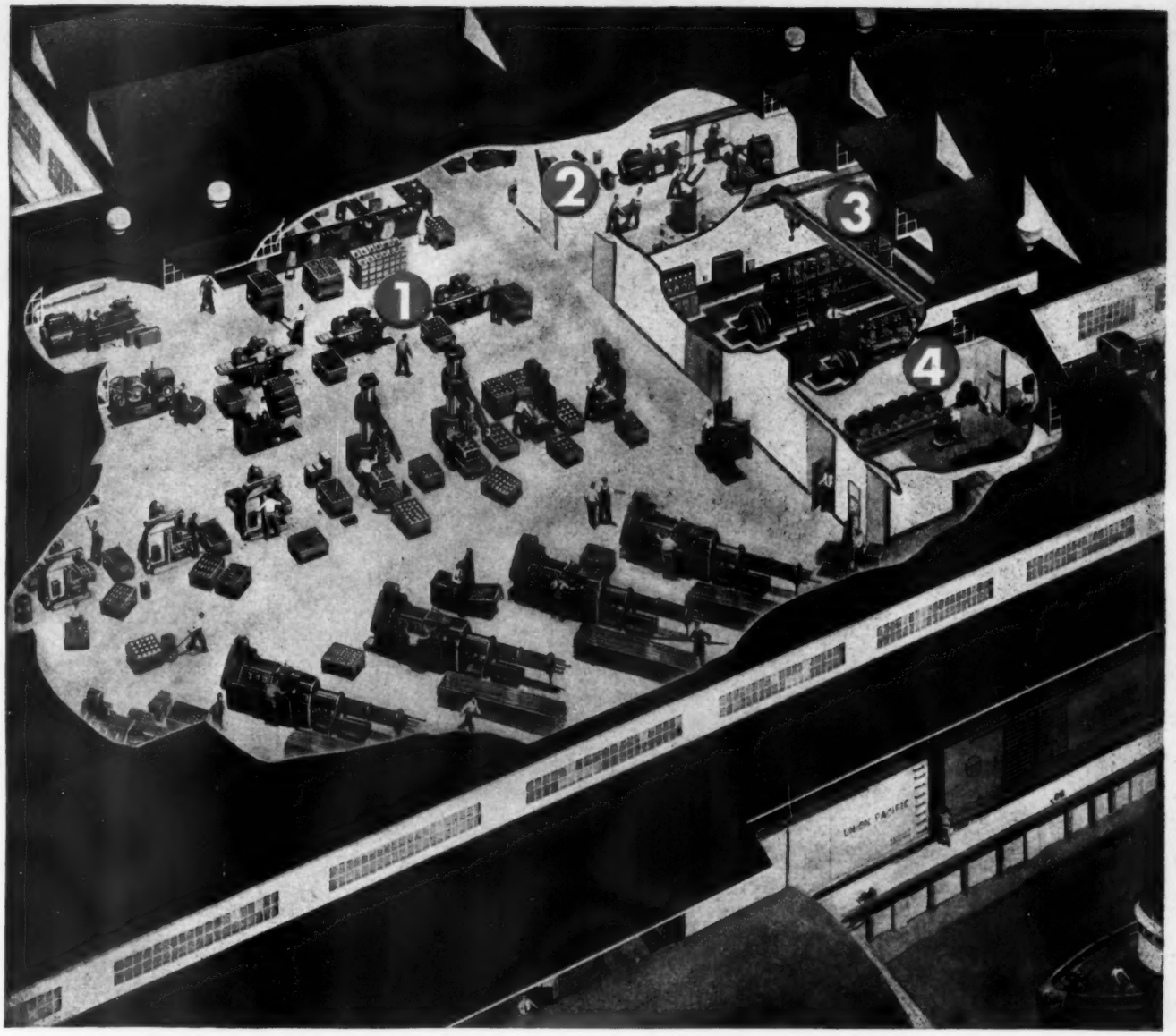
Just as we did in the above case—and in many others—we'll be glad *to prove to your satisfaction* the ease, the simplicity, and the *inexpensiveness* of installing Fitchburg Bowgage Heads on your present grinders. With your grinding equipment thus modernized, the resulting mass production applied to your precision grinding will soon pay off the small cost involved.

The FITCHBURG Bowgage Head is a self-contained grinding unit, with *all* its movements and controls within itself. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position—all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed—thus protecting your investment in grinding machinery. Fitchburg engineers will welcome the opportunity to help you solve your grinding modernization problem. There is, of course, no charge for this service. Send us the details—blueprints if available—and see how easily and inexpensively *you too* can have FITCHBURG AUTOMATIC PRECISION GRINDING in your shop.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders



Find these hidden Profits... inside your plant!

1 MORE CONTINUOUS PRODUCTION

Vital factor in any production picture is steady, uninterrupted machine operation. Socony-Vacuum Correct Lubrication assures peak machine efficiency and greater overall production.

2 LOWER MAINTENANCE COSTS

Correct oils and greases prolong machine life, reduce production losses due to "downtime", minimize repair bills. This means important savings, increased profits.

3 REDUCE POWER CONSUMPTION

By reducing friction losses, Socony-Vacuum lubricants cut power waste. In the power plant, correct oils keep turbines, Diesels, steam engines and air compressors operating at peak efficiency.

4 LOWER LUBRICATION COSTS

Quality lubricants stand up longer, give maximum protection with minimum consumption. Ultimate lubrication costs are lower. Get these profits for your plant.

GARGOYLE Lubricants

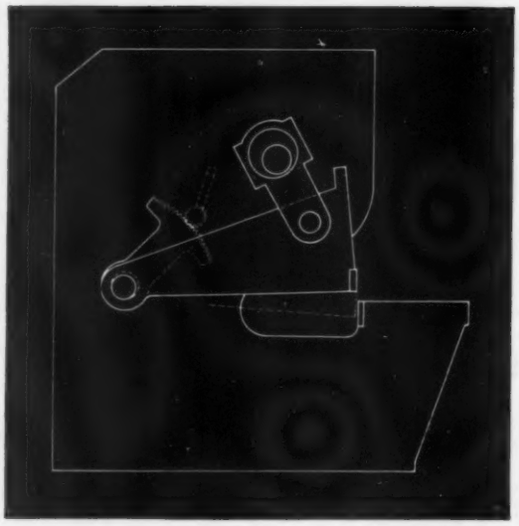
Socony-Vacuum Oil Company, Inc.

and Affiliates: Magnolia Petroleum Company, General Petroleum Corporation

STEELWELD ANNOUNCES..

A SHEAR OF REVOLUTIONARY PIVOTED BLADE DESIGN

After more than 10 years of engineering and development work Cleveland Crane has perfected and is now offering a line of power-driven metal-cutting shears that are new and radically different from all other shears now on the market.



A revolutionary pivoted-blade principle is employed that makes possible several outstanding advantages and overcomes certain handicaps of present-day guillotine type shears. There are no slides and guides to wear out of true and cause inaccuracies. The upper blade operates on two heavy pivot pins secured to the end housings and travels in a circular path.

The knife clearance is easily adjusted to suit the plate thickness by turning a convenient hand crank. A large dial indicator shows the thickness that may be cut for any knife setting.

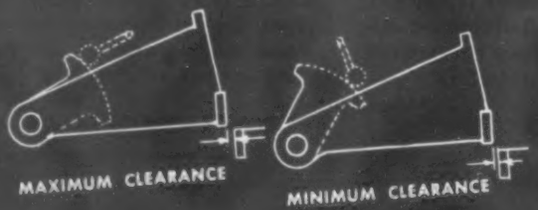
A complete line of Steelweld Shears has been developed for cutting plate of all thicknesses from 12 gauge to 1¼ inch and for lengths of 6 feet to 18 feet. They may be arranged for squaring, slitting and notching. Speeds range from 60 strokes per minute on the smaller sizes to 25 strokes per minute on the largest shear.

3 Outstanding Features

1 UPPER KNIFE TRAVELS IN CIRCULAR PATH

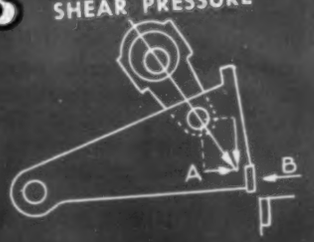
Blade turns on pivot pins. No guides and slides, as in guillotine-type shears, to wear and cause inaccuracies. Upper knife swings away from lower one, increasing distance "A" from back gauge to stationary knife, thereby permitting sheared pieces to drop freely without binding.

2 FAST KNIFE ADJUSTMENT



Knife clearance easily and quickly made to suit every plate thickness. No bolts to loosen; no parts to move. It is only a matter of turning a crank and watching the indicator which indicates the clearance in thousands of an inch and also shows the plate thickness that may be cut for any knife setting.

3 COUNTERACTING SHEAR PRESSURE

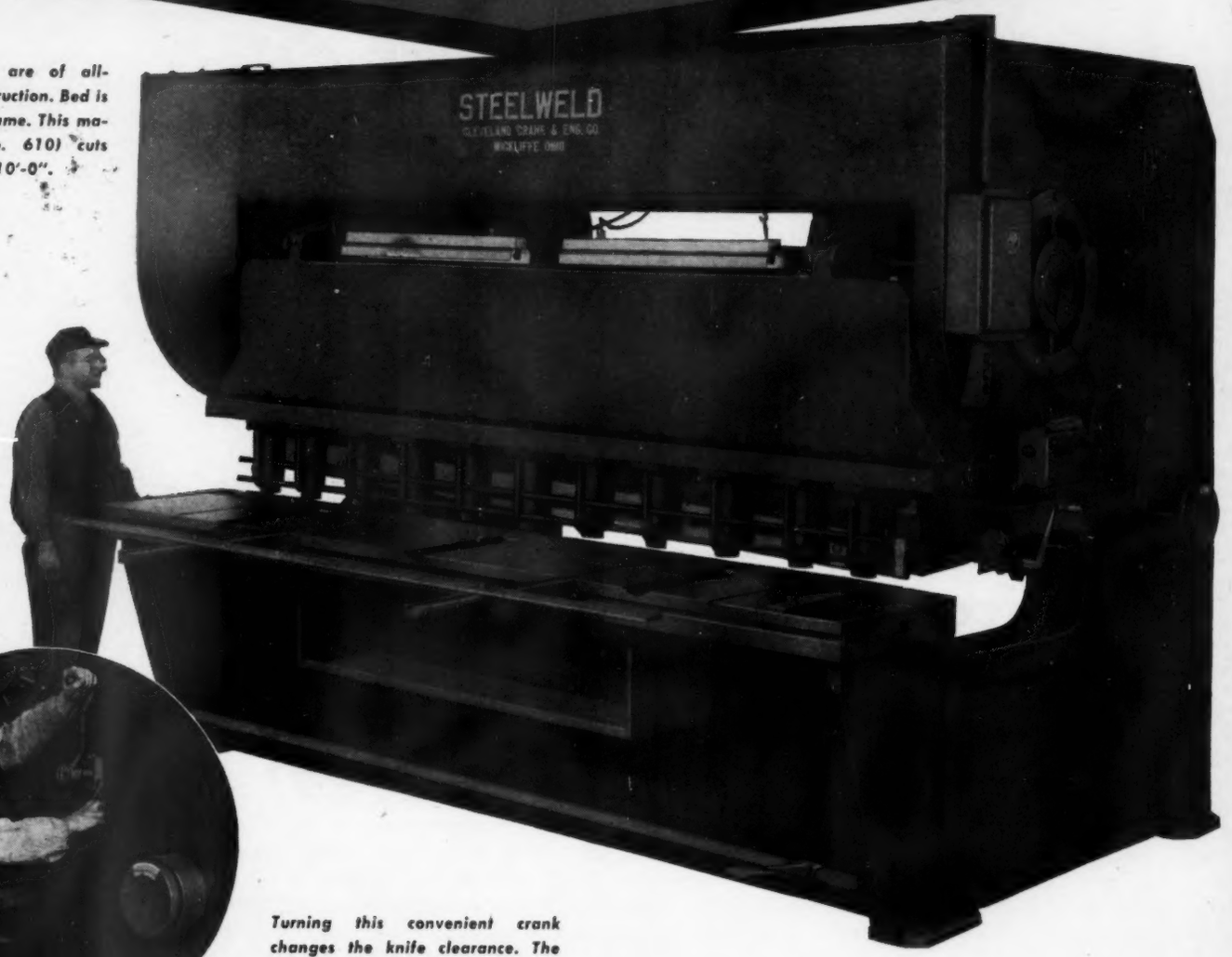


The shearing force is so applied that its horizontal component "A" will approximately equal and counteract pressure "B" that develops in the knives during shearing, tending to spring them apart. This reduces the load on the blade pivot pins to a negligible amount and assures long trouble-free life at these points.

16 IMPORTANT ADVANTAGES

1. Knife clearance easily adjusted to suit plate thickness.
2. Smooth, clean cuts.
3. Accurate, straight and true edges.
4. Easy and simple to operate.
5. Fast cutting and high production.
6. Minimum maintenance.
7. No slides or guides to wear.
8. Trouble-free mechanical hold-downs.
9. Easily arranged for squaring, slitting or notching.
10. Convenient back gauge.
11. Negligible twist, camber and bow in cut pieces.
12. Quiet operating.
13. Designed for safety throughout.
14. Long knife wear between grindings.
15. Knives easily removed or replaced.
16. All-welded one-piece frame with bed integral.

elweld Shears are of all-ded steel construction. Bed is egral part of frame. This ma-e (Model No. 610) cuts te up to 3/4" x 10'-0".



Turning this convenient crank changes the knife clearance. The indicator shows plate thickness that may be cut for any knife setting.

T THIS BOOK!

g No. 2011 gives complete . Ask for free copy.

STEELWELD PIVOTED BLADE SHEARS

THE CLEVELAND CRANE & ENGINEERING COMPANY
1127 EAST 283rd ST. • WICKLIFFE, OHIO

How can they COUNT on the thickness of a sheet of steel?

FROM HIS PULPIT, this rolling-mill operator can see at any moment whether there is any variation . . . *even down to 0.0001"* . . . in the thickness of the steel sheet passing between the rollers in front of him. Nor does this take "second sight" or "X-ray eyes." For facing him is a Veeder-Root Counting Device, built-in as an integral part of an electrolimit gage housed in alloy steel of low thermal expansion. This counter is pre-set to the space between the rolls. And when these rolls are in contact with the steel strip, the operator gets a continuous *direct*, micrometric reading which indicates in decimals any variations in the strip passing by.

So it's easy for him to keep everything under constant *Count*rol . . . to keep himself free from the nerve-frazzle of threatening errors, eye-fatigue, and damage to his equipment. In fact, in *all* precision operations, this is the trend in micrometric measurement. . . . direct, decimal readings that are plain and unmistakable. And *you* can count on Veeder-Root to give you the same *Count*rol as here . . . facts-in-figures you can count on to tell you the truth, protect your profits, save you time. Write.

The Counting House of Industry

VEEDER-ROOT INC.

Hartford 2, Connecticut

***In Canada*: Veeder-Root of Canada, Ltd., Montreal**
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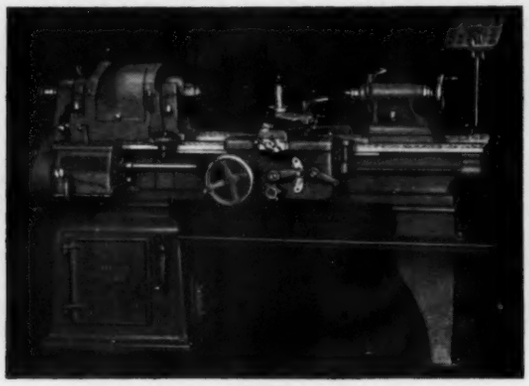
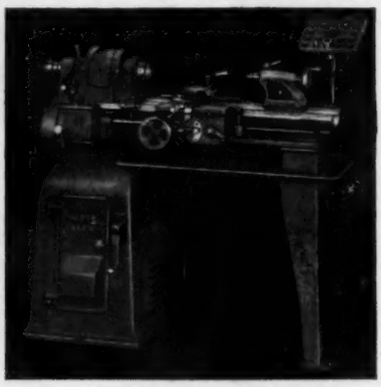
SOUTH BEND *Precision* LATHES

ENGINE LATHES • TOOLROOM LATHES • TURRET LATHES • ATTACHMENTS

No. 1001-Z SOUTH BEND TURRET LATHE



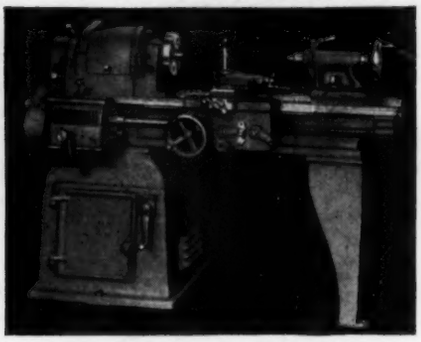
16" x 6' SOUTH BEND TOOLROOM LATHE



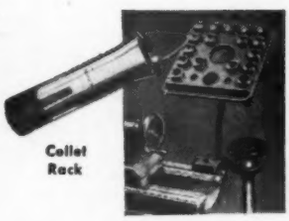
10" x 3½' SOUTH BEND TOOLROOM LATHE

13" x 5' SOUTH BEND TOOLROOM LATHE

9" x 3' SOUTH BEND MODEL A BENCH LATHE



14½" x 5' SOUTH BEND ENGINE LATHE



Collet Rack

Thread Dial Indicator

Micrometer Carriage Stop

A Size and Type for Every Need

Accurate, versatile, fast, and easy to operate, South Bend Precision Lathes simplify the handling of difficult, close tolerance jobs in all types of laboratory, toolroom, production, and maintenance work. Practical South Bend attachments and accessories increase the scope of these lathes, and speed tooling and production.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, and bed lengths to 12'. Turret Lathes are made with 9" and 10" swings, and maximum collet capacities to 1".

WRITE FOR CATALOG 100-D

Illustrates in full color, and gives complete, detailed specifications of all types, sizes, and models of South Bend Precision Lathes; shows all South Bend lathe attachments and accessories. Mailed free on request.

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Electric Grinding Attachment

Draw-in Collet Attachment

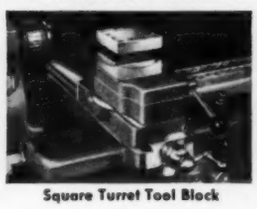
Draw-in Collet Attachment

Center and Follower Rests

Telescopic Taper Attachment

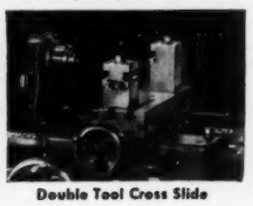
Collets and Collet Sets

Handlever Bed Turret

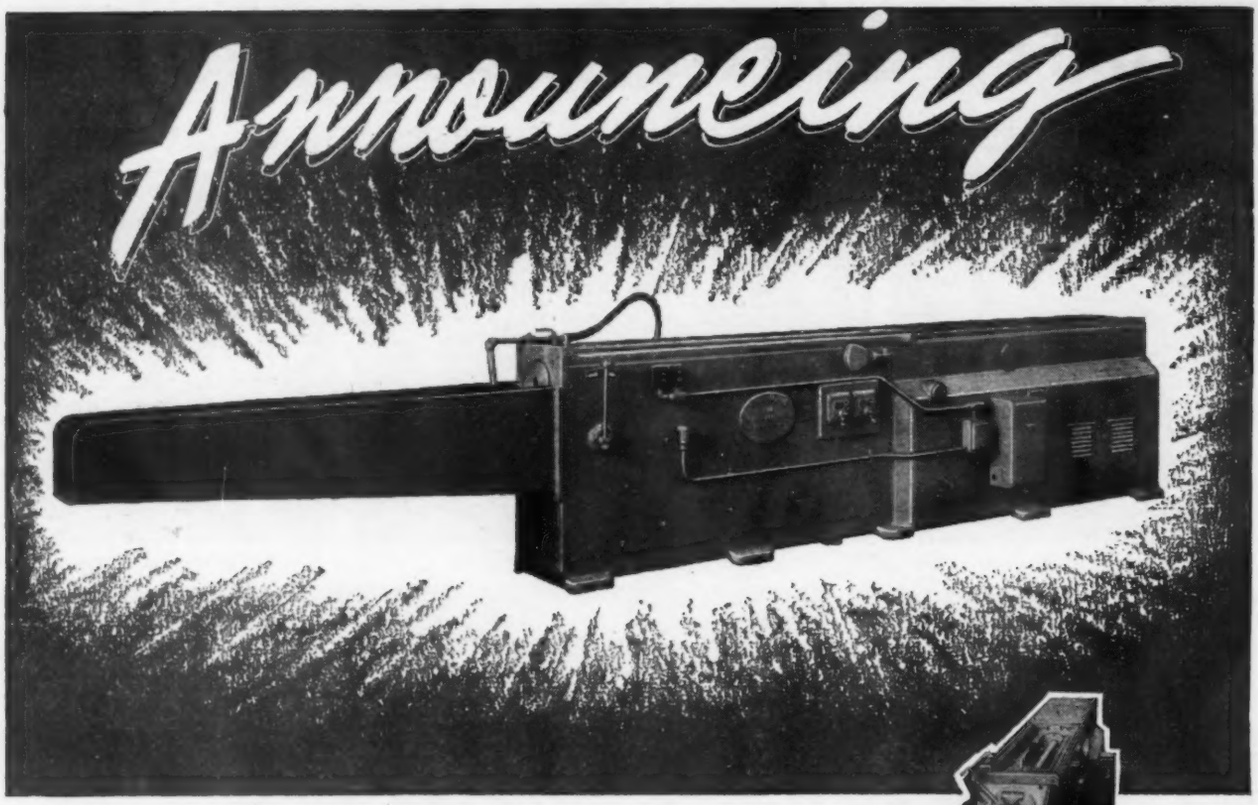


Square Turret Tool Block

Double Tool Cross Slide



Double Tool Cross Slide



A NEW *American*

HORIZONTAL BROACHING MACHINE

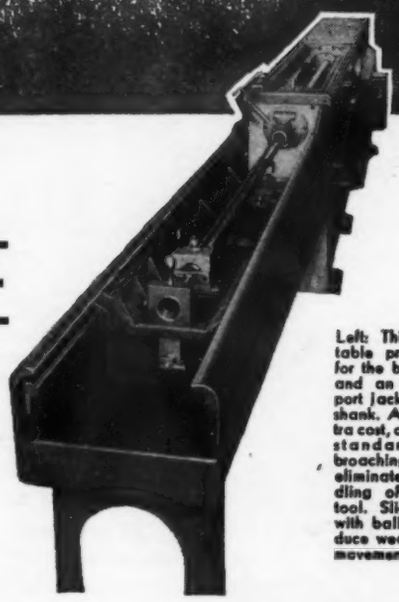
For Heavy-Duty Internal and Surface Broaching

Engineered by *American*, this new horizontal broaching machine is designed to perform a wide variety of internal and surface broaching operations. It is particularly adapted to heavy-duty broaching involving the removal of a large amount of metal or broaching of large work pieces. As always, fast, accurate production with fine finish is possible.

This new *American* machine is made in two standard sizes, as shown in the table below:

	MODEL HD-15-66	MODEL HD-20-66
Pull Capacity	15 tons	20 tons
Stroke	66"	66"
Maximum Length of Broaching Tool	72"	72"

Write for complete details on these and other *American* broaching machines.



Left: This outer support table provides a guide for the broach rear pilot and an automatic support jack for the broach shank. Available, at extra cost, on all *American* standard horizontal broaching machines, it eliminates manual handling of the broaching tool. Slide is equipped with ball bearings to reduce wear and facilitate movement.

MEMBER BROACHING TOOL INSTITUTE

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

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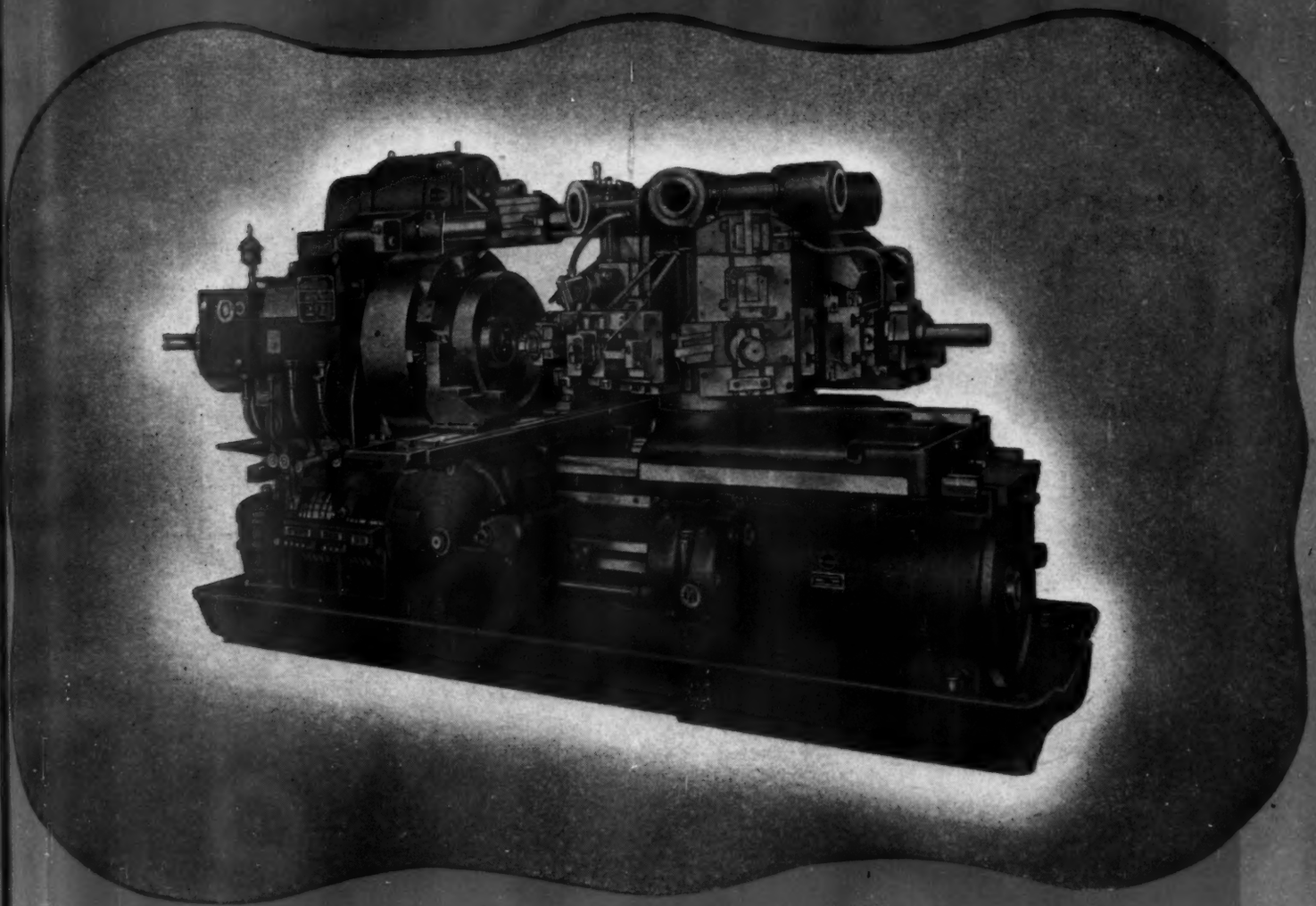
P&J 8 DT 8 DXT AUTOMATICS

for production of work requiring greater capacity and lower cost...



CONDENSED SPECIFICATIONS

	8 DT	8 DXT
Number of Turret Faces	6	6
Turret Travel	32"	32"
Turret Feed	10"	10"
Turret Slide Adjustment	6⅝"	13⅝"
Swing over bed	20"	20"
Swing over cross slide	23"	23"

Authorized Agent U. S. War Assets Corp.

These additions to the famous lines of P&J Automatic Chucking and Turning Machines provide that extra capacity required for the handling of large work requiring close tolerances and high output at reduced costs.

Both the 8-DT and the 8-DXT Automatics employ unit construction throughout. Base is of heavy box section, provided with hardened, and ground steel ways of liberal dimensions. A rugged, well-balanced turret slide construction assures accuracy and long service.

The specific features of these machines are described in detail in Bulletin 112, sent without obligation on request.

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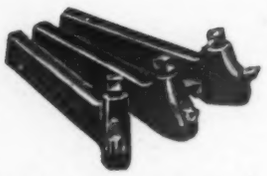
POTTER & JOHNSTON MACHINE CO.
Pawtucket, R. I.

ARMSTRONG

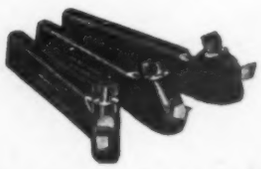
SYSTEM OF TOOL HOLDERS

What speed do you need? 100, 300 or 600 ft. p.m.

Whatever cutting speed is required, whatever the material to be machined, there are correctly designed ARMSTRONG TOOL HOLDERS with bits, blades and cutters of the most efficient cutting material provided by the Armstrong System of Tool Holders.



ARMSTONG TURNING TOOLS for ARMSTRONG HIGH SPEED or other high speed steel cutter-bits



ARMSTRONG CA TOOL HOLDERS for ARMALOY and similar cast-alloy cutter-bits

ARMSTRONG Carbide TOOL HOLDERS for ARMIDE and similar carbide-tipped cutters

Included are: ARMSTRONG TOOL HOLDERS AND CUTTERS	*Recommended Cutter Speed*
ARMSTRONG Turning Tools for ARMSTRONG HIGH SPEED Cutter Bits	50-150 ft. p.m.
ARMSTRONG CA Tool Holders for ARMALOY and similar cast alloy cutters	100-350 ft. p.m.
ARMSTRONG Carbide Tool Holders for ARMIDE and similar carbide-tipped cutters	300-600 ft. p.m.

Write for new Circulars "Armide" and "Armaloy" circulars.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

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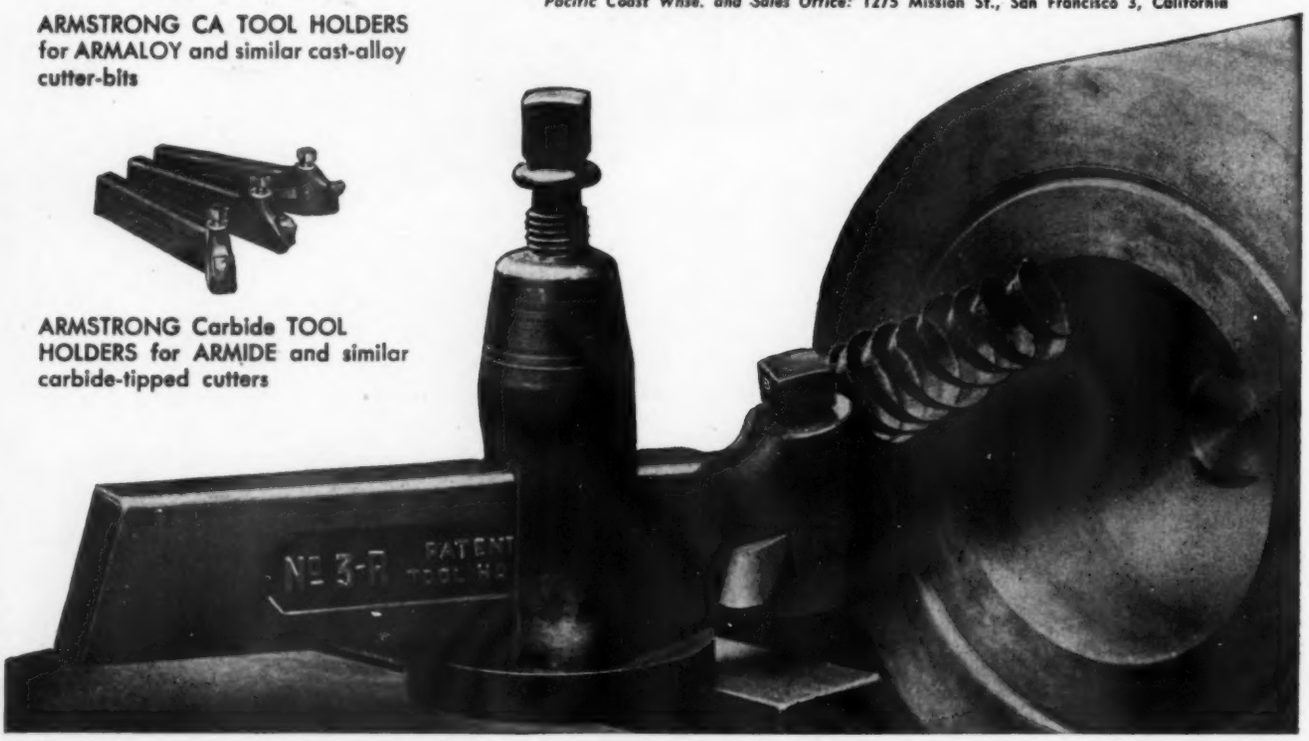
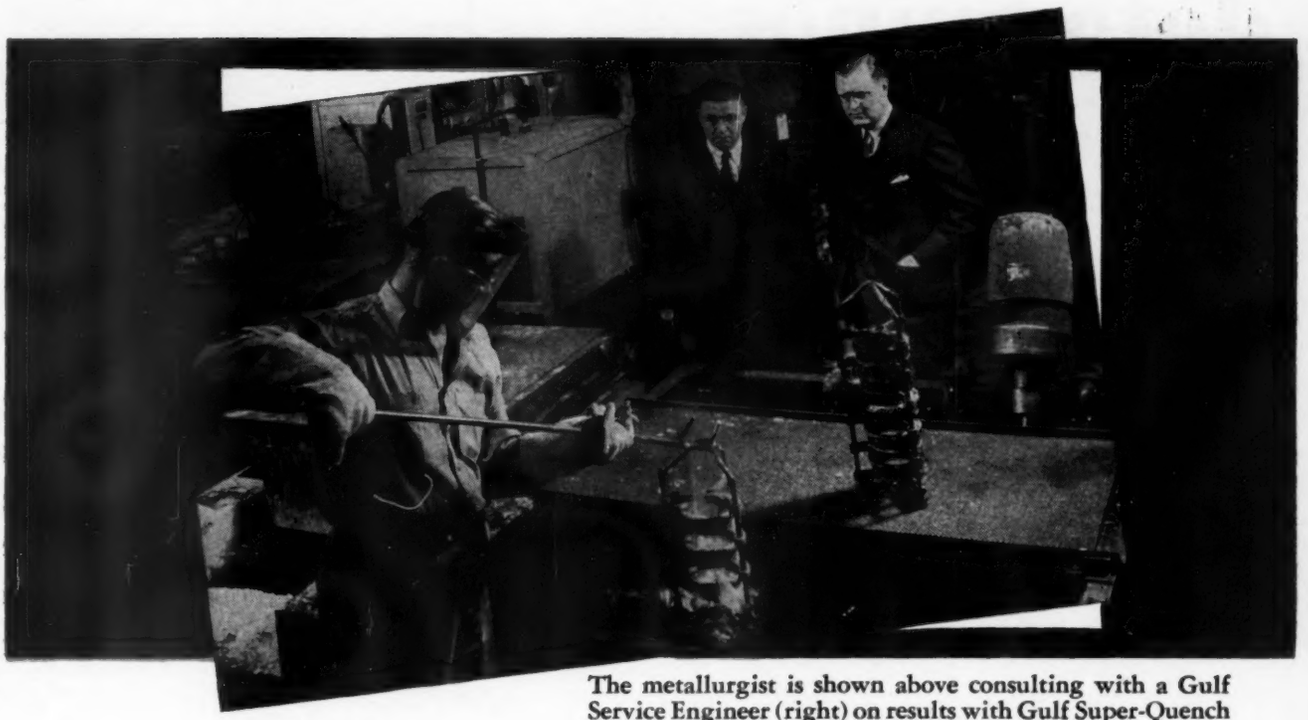


"With Gulf Super-Quench

we consistently get maximum hardening and no rejects for low hardness or distortion"

says this Metallurgist



The metallurgist is shown above consulting with a Gulf Service Engineer (right) on results with Gulf Super-Quench in quenching counter balance bearings.

"TO get correct case and core hardness and avoid distortion, the quench for our counter balance bearings has to be right," says this Metallurgist. "With Gulf Super-Quench we get just the results we want—maximum hardening on the case, and no rejects for low hardness or distortion."

Here's why Gulf Super-Quench is a superior quenching oil: It has intensified dual-action—a faster cooling rate through the hardening temperature range, and the slow speed of conventional quenching oil below the hardening temperature range. Call in a Gulf Service Engineer today and let him show you how Gulf Super-Quench can help improve your quenching practice. For your copy of the brochure on Gulf Super-Quench, send the coupon below.

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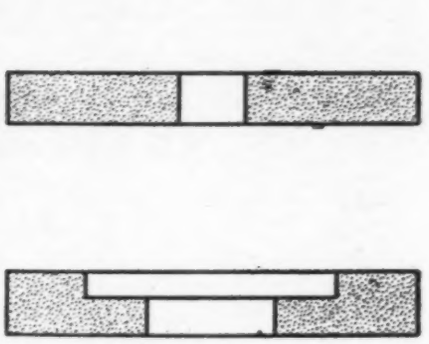
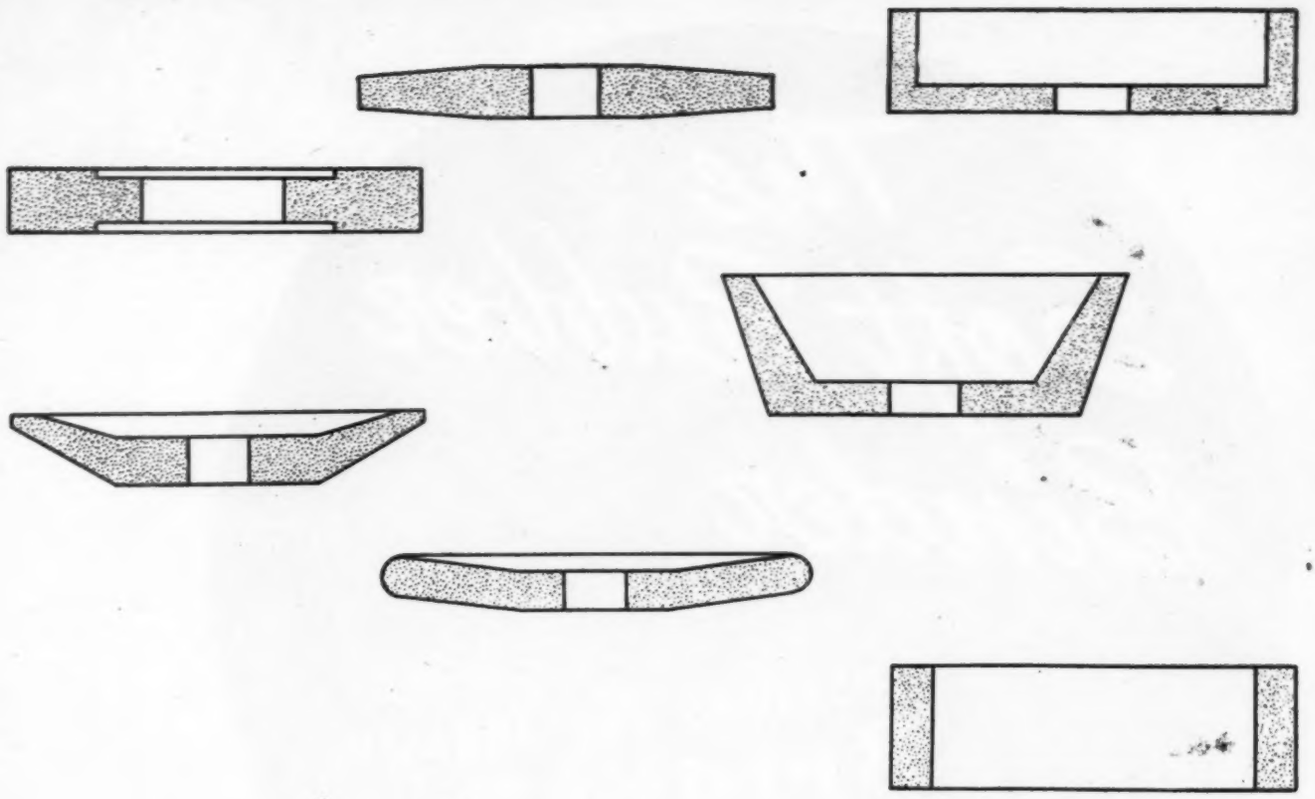
Sometimes a different shape determines better grinding



In terms of grinding wheel life, as well as efficiency and economy—the wheel shape selected for a specific operation is worth careful consideration. This is equally true for both production operations and tool-room grinding.

To help you check your grinding operations...to assist in selecting the best combination of shape, grit, grade and bond, follow the simple plan of many top notch production men. Consult with your CARBORUNDUM salesman or our distributor's representative. Many customers consider his opinions of real, practical value. His suggestions are based on a knowledge of latest

A good rule for good grinding... **CALL**



abrasive developments... supported by daily experience with plenty of on-the-job grinding applications.

If the problem is unusually difficult, the CARBORUNDUM representative may call in an Abrasive Engineer for consultation. Both representative and Abrasive Engineer have available the facilities and resources of the world's most noted abrasive laboratories.

Through this single practice, of calling in CARBORUNDUM, you can be sure of getting maximum efficiency from your grinding wheels and other abrasive products. The Carborundum Company, Niagara Falls, New York.

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TRADE | MARK

BONDED ABRASIVES

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- Silicon Carbide
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for:
Polishing
Lapping
Pressure Blasting
Finishing

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The Soft Rubber Binder
CUSHIONS THE ABRASIVE—
Brightboy
For Finer, All-In-One
BURRING, FINISHING, POLISHING
At Lower Cost
See how YOUR OPERATIONS between the grind and the buff CAN BE REDUCED TO ONE with Brightboy.
DISCOVER the possibilities which Brightboy offers for one-operation finish and polish, because of the unique cleaning and polishing action of its soft rubber binder, which works *simultaneously* with the abrasive.
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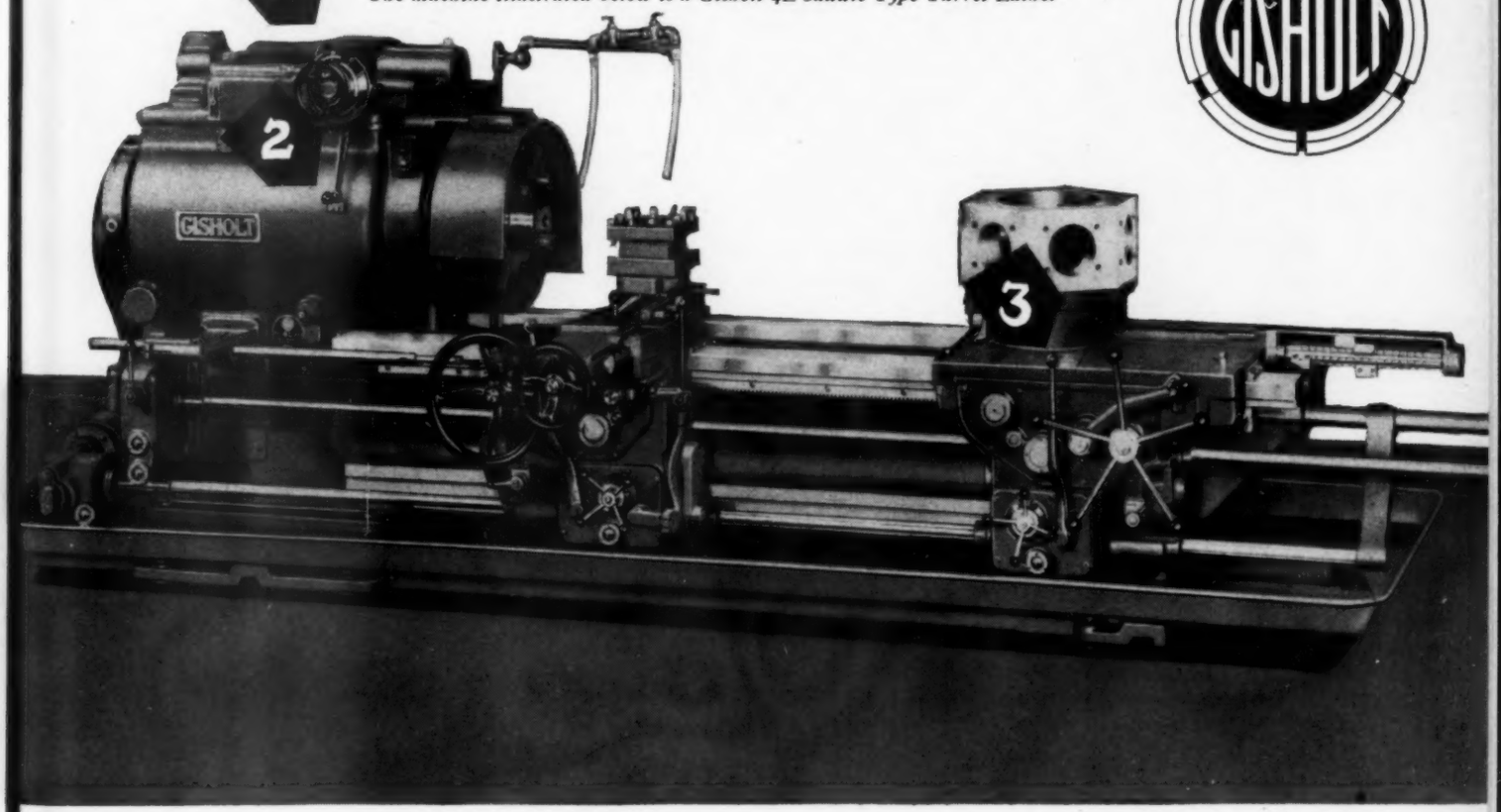
3 ways to increase production

Actual cutting time on a turret lathe is usually determined by using the maximum speeds and feeds the cutting tools will withstand. Isn't it true, therefore, that the greatest opportunity for time-saving is in cutting the lag between cuts?

By substituting automatic operation for certain manual motions, Gisholt Turret Lathes have made it possible to increase the percentage of actual cutting time in relation to the complete cycle. This means increased production—lower machining costs.

GISHOLT

The machine illustrated below is a Gisholt 4L Saddle Type Turret Lathe.



Spindle speed changes can be made instantly without stopping the spindle or releasing the main drive clutch. The Gisholt Hydraulic Speed Selector, power operated, eliminates manual gear shifting. It may be operated either direct or pre-set.

Hydraulic spindle control provides for starting, stopping or reversing by a mere touch of this handy lever. When in neutral position, braking is automatic, bringing the spindle to a quick, smooth stop. Headstock control is as easy as pressing buttons.

Power rapid traverse for both hexagon and square turrets insures quicker movement of tools in and out of cutting position. With transverse travel of the cross slide, time savings are substantial on many jobs. Operating effort is reduced to a minimum.

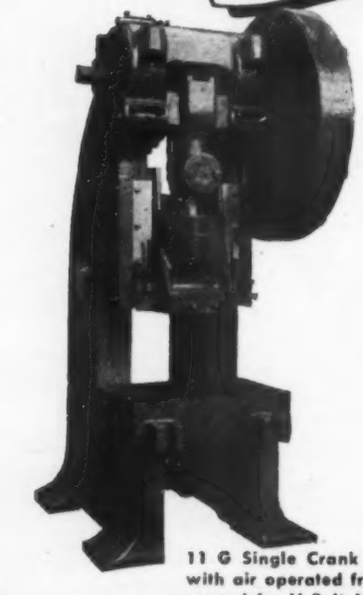
LOOK AHEAD...KEEP AHEAD...WITH GISHOLT

GISHOLT MACHINE COMPANY

1201 E. Washington Avenue · Madison 3, Wisconsin

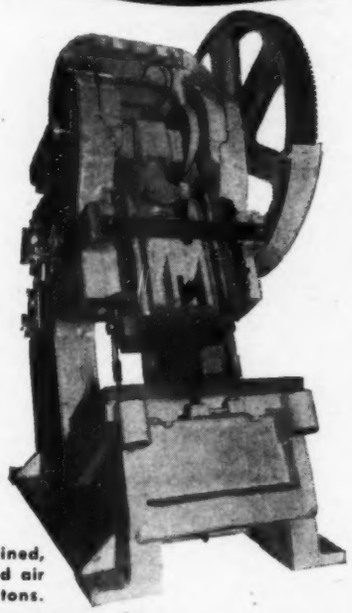
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

CLEVELAND OPEN BACK GAP PRESSES



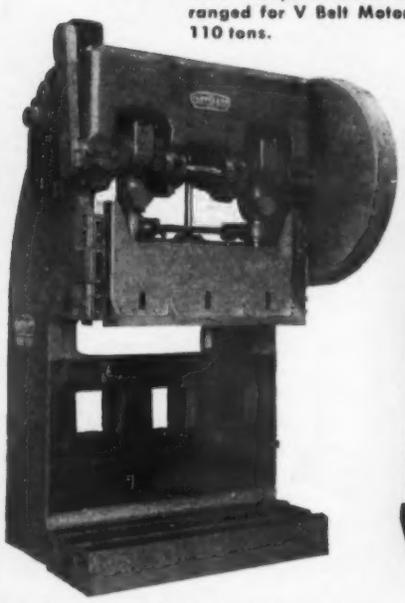
This type of Press is recommended for the convenience which the frame affords in the handling of large or irregular sheets and for feeding strip stock right and left across the dies. They are used extensively in the Automotive, Electrical, Agricultural and many other industries for punching, shearing, perforating, bending and forming operations.

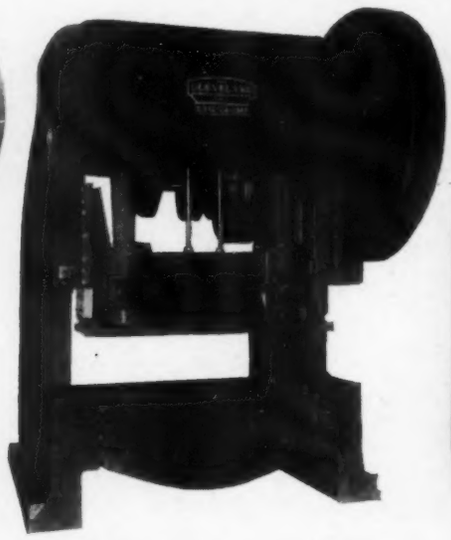
Built in wide range of standard sizes in both Single and Double Crank they can be modified in many respects to suit particular requirements.



11 G Single Crank Gap Press equipped with air operated friction clutch, and arranged for V Belt Motor Drive. Capacity 110 tons.

15 G Single Crank Gap Press, inclined, equipped with electrically controlled air operated friction clutch. Capacity 215 tons.





50-G-54 Double Crank Gap Press, flush front, equipped with air operated friction clutch, air counterbalance, air brake on flywheel. Capacity 90 tons.

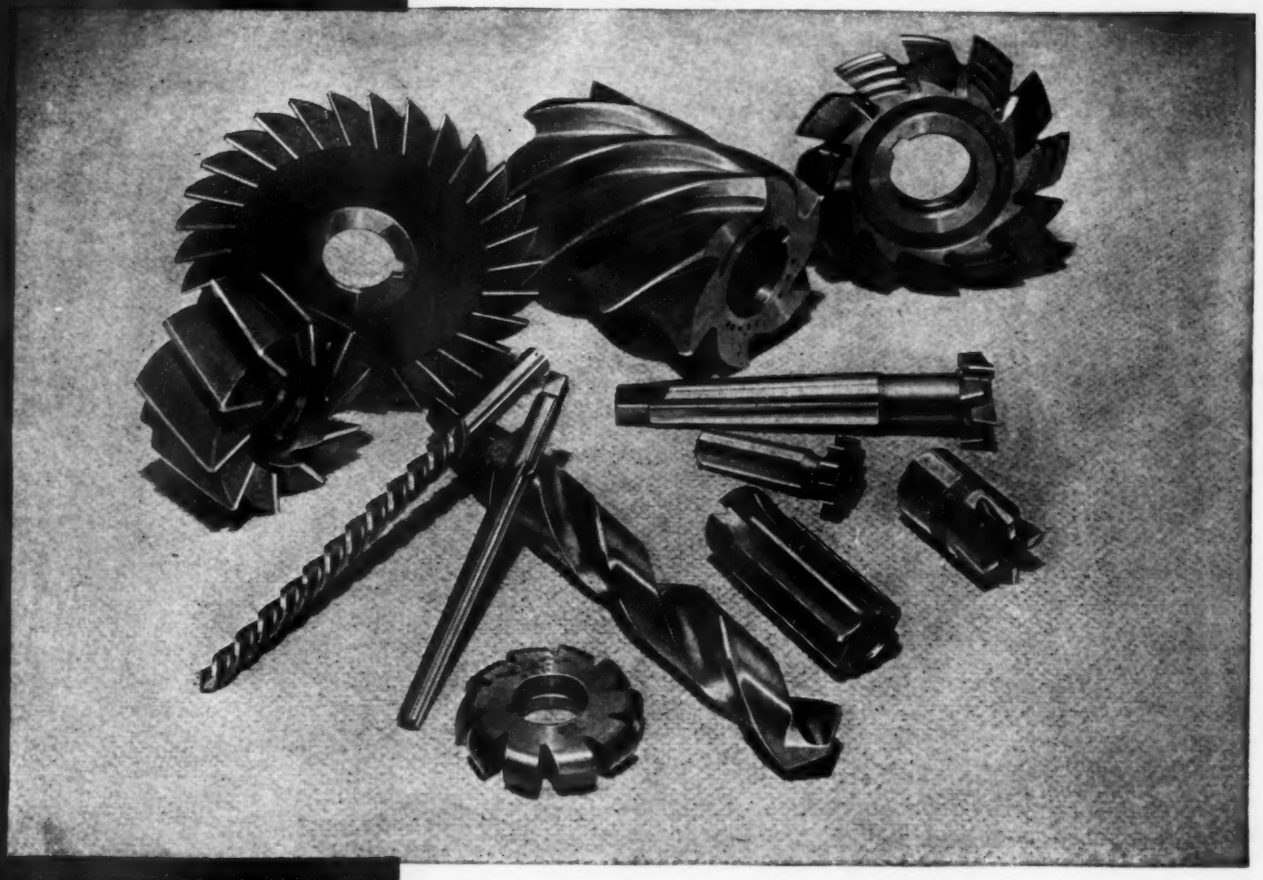
65-G-72 Double Crank Gap Press, equipped with electrically controlled air operated friction clutch. Capacity 150 tons.

80-G-96 Double Crank Gap Press, flush front, equipped with hydraulically operated friction clutch, air counterbalance. Capacity 255 tons.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

Cleveland 14, Ohio

Picture of Perfection



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New York: 61 Reade St. — San Francisco: 121 Second St.
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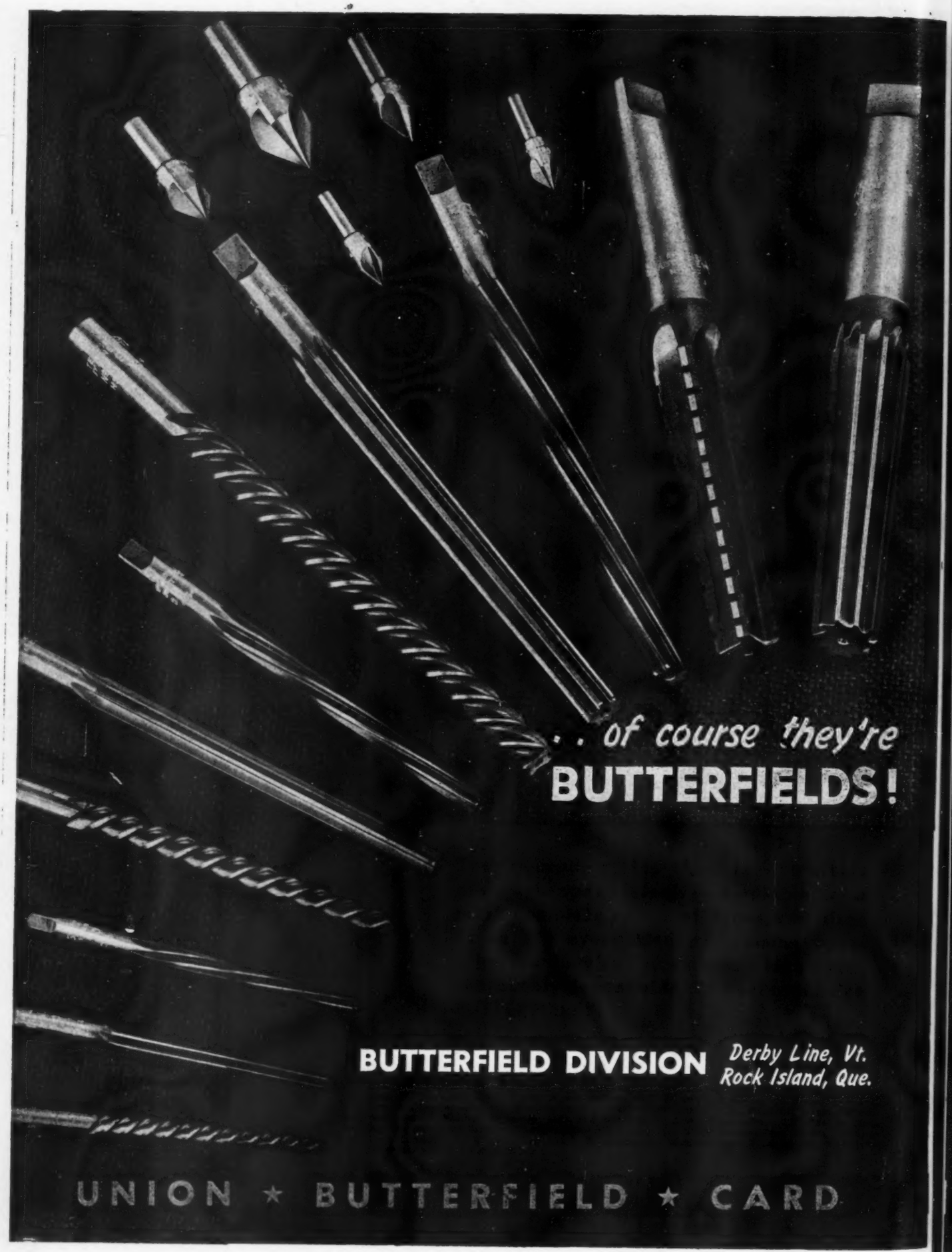
Detroit: 5527 Woodward Ave. — Seattle: 568 First Ave., South


. . . of course they're
BUTTERFIELDS!
BUTTERFIELD DIVISION
Derby Line, Vt.
Rock Island, Que.
UNION ★ BUTTERFIELD ★ CARD

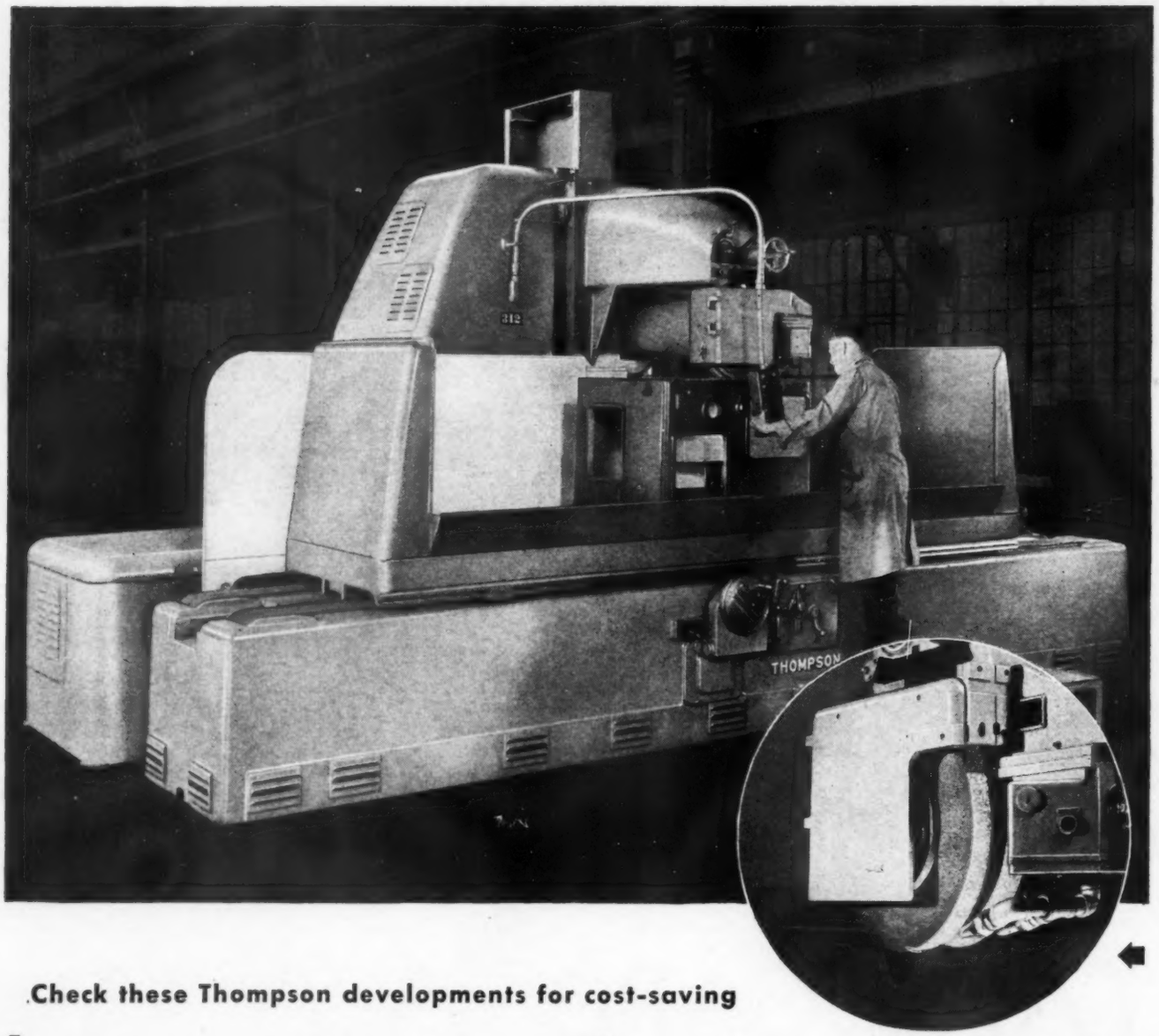
Machine Screw

TAPS by CARD

S. W. CARD MFG. CO.

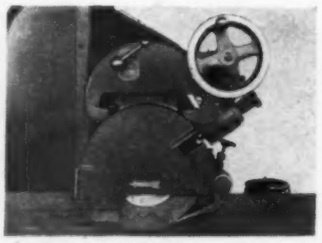
Mansfield, Mass.

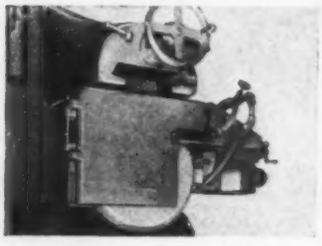
Divisions of the Union Twist Drill Company



Check these Thompson developments for cost-saving

1. AUTOMATIC WHEEL TRUING (pioneered by Thompson). The stationary truer provides instant availability of the truing tool and all wheel head slides are now equipped with hydraulic wheel truing feeds. It is not necessary to disturb the work piece in order to true the wheel.





2. ANGULAR WHEEL TRUING (pioneered by Thompson). Attachment equipped with two truing tools, both sides of the included angle are trued simultaneously. Universal motor with speed variation 5" to 40" p.m. controlled by governor insures accurate, smooth truing for fine finish and precision on piece work.

3. AUTOMATIC DOWN FEED (exclusive Thompson feature). Feed cycle of .00025" to .004" is available at each table reversal for plunge cutting or at each wheel head feed reversal. Feed mechanism has automatic trip—can be pre-set for size control from elevating hand wheel graduations, duplicating accuracy to .0002".

4. AUTOMATIC SPARK-OUT CONTROL (exclusive Thompson feature). Allows table and wheel head to continue finishing cuts after automatic down feed device has reached pre-determined size. At fixed time after work size is reached, table rapid traverses to loading position and stops automatically. Usually fur-

COPYRIGHT 1946, THE THOMPSON GRINDER CO. INC.

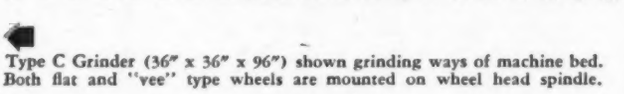
Before you buy, *investigate!*

THESE 8 THOMPSON DEVELOPMENTS OFFER MORE EXCLUSIVE FEATURES TO HELP YOU REDUCE GRINDING COSTS

You will find most of the important cost-saving developments in surface grinders on Thompson machines because Thompson has been a successful pioneer in this field. All eight of the outstanding improvements described here have been pioneered by Thompson . . . *and six of them are exclusively Thompson features.*

That is why it is so important to investigate the complete line of Thompson machines and check them against your grinding requirements. And the time to investigate is now . . . *before* you invest in expensive equipment that may become quickly obsolete.

Through the years, Thompson grinders have a record for being good long-time investments. Check these Thompson-Pioneered features and write today for complete details of Thompson cost-saving machines.



Type C Grinder (36" x 36" x 96") shown grinding ways of machine bed. Both flat and "vee" type wheels are mounted on wheel head spindle.

nished in conjunction with automatic down feed. This device maintains accurate duplication of dimensions and makes possible battery installations by releasing operator for loading other machines.

5. FLAME HARDENED BEARINGS (exclusive Thompson feature). Wheel head slide ways are flame hardened and precision ground for *permanent* accuracy.

6. PRESSURE LUBRICATED SPINDLES (exclusive Thompson feature). Direct-powered wheel-head spindle of heat-treated alloy steel in silver-lined bearings is permanently vibration-free. Positive automatic *pressure lubrication* is provided by pump interlocked with spindle motor.

7. ANTI-FRICTION ELEVATING UNIT (exclusive Thompson feature). Friction between screw and nut is reduced 70% to permit accurate feeding to .0001". Also minimizes effort of moving saddle assembly when making new setups without power elevation. Permits inexperienced operators to finish work by following handwheel graduations.

8. DOUBLE-LENGTH BED (exclusive Thompson feature). Massive *double-length* solid-cast beds are provided with heavy cross-section and numerous ribs at vital points to provide absolute rigidity for table.

Check the Thompson line first

In addition to a complete line of hydraulic surface grinders from 6" x 18" to 36" x 240", Thompson offers Broach Grinding Machines . . . fully automatic and hand feed types for round or flat broaches . . . and the famous new *Thompson Truforming* Grinders, completely engineered units with *two* crushing rolls permitting practical production of precision flat form contours for the first time. Write for details.

ADDRESS DEPT. 16

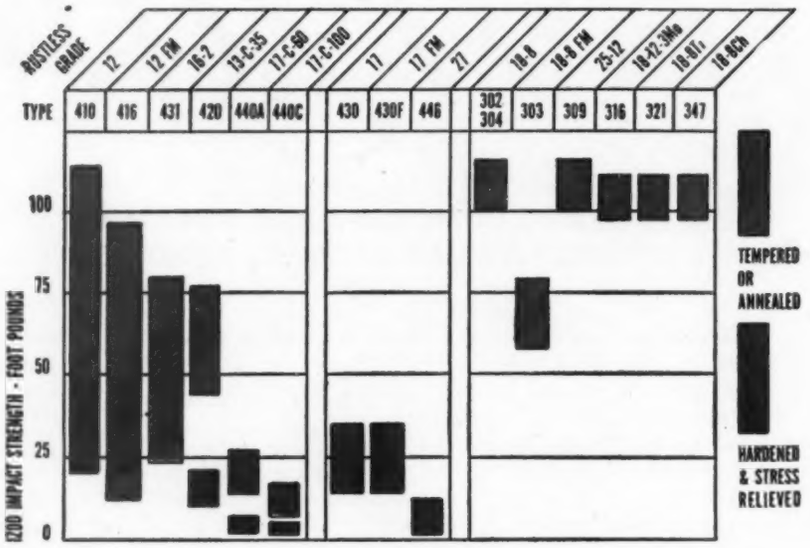
THE THOMPSON GRINDER COMPANY, INC.
SPRINGFIELD, OHIO

Thompson SURFACE Grinders

RUSTLESS DATA SHEET NO. 4

Corrosion Resistance Plus Toughness

One of the Many Combinations of Properties Offered by Stainless Steels



IZOD impact values, as shown in the above chart for all standard grades of stainless steels, may not represent true mechanical properties directly usable in engineering design, but they are an indication of the great notch toughness offered by stainless steels. The energy in foot-pounds absorbed in breaking the notched test specimen results in stress concentration which is undoubtedly far greater than will occur in any well-designed product in service. However, stress concentrations cannot always be predicted or eliminated and it is often necessary to avoid the safety hazard by using a material which has the capacity to distribute a load at a notch, especially when corrosive attack can cause the "notch." Stainless steels are such materials.

Depending upon the condition, whether hardened or annealed, the martensitic (group on left) show a variation of impact values. The austenitic or chromium-nickel grades (group on right) exhibit extremely high values—higher than any standard engineering alloy. The latter also have the remarkable property of retaining their great toughness at temperatures far below zero. For this reason type 304 stainless steels have been widely used for equipment handling liquid oxygen and nitrogen at hundreds of degrees below zero Fahrenheit. At 100° F. this grade has an Izod impact range of 105-125 foot-pounds. Large quantities have been used in essential working parts of high flying aircraft.

Considering versatility as an important design and fabrication requirement, it can be said that stainless steels offer extreme toughness but still retain adequate workability. Fabricating stainless steels is just different—not difficult. If you need a material to withstand both corrosion and shock stresses, one of Rustless' stainless steels may be your answer.

As engineering materials, stainless steels offer designers durability, strength, stiffness, economy and sales appeal, in addition to this quality we call toughness. Of course, the proper grade should be selected to meet specific conditions of service and fabrication. That is where Rustless' specialized stainless-steels experience can help. Consult us on your design problems.

• • •

This is a notched Izod impact test specimen after it absorbed a force of 82 foot-pounds at room temperature. The grade is Rustless 18-8FM, Type 303 which, incidentally, is machinable at rates exceeding 75% of those used for Bessemer screw stock. It will resist severe corrosion conditions, too. Quite a material!

Valuable Rustless booklets and leaflets are freely available to you, providing technical data, machining methods, how to electropolish stainless, how to blacken it, etc. Write for complete list of available Rustless publications.

Rustless

STAINLESS STEEL SPECIALISTS

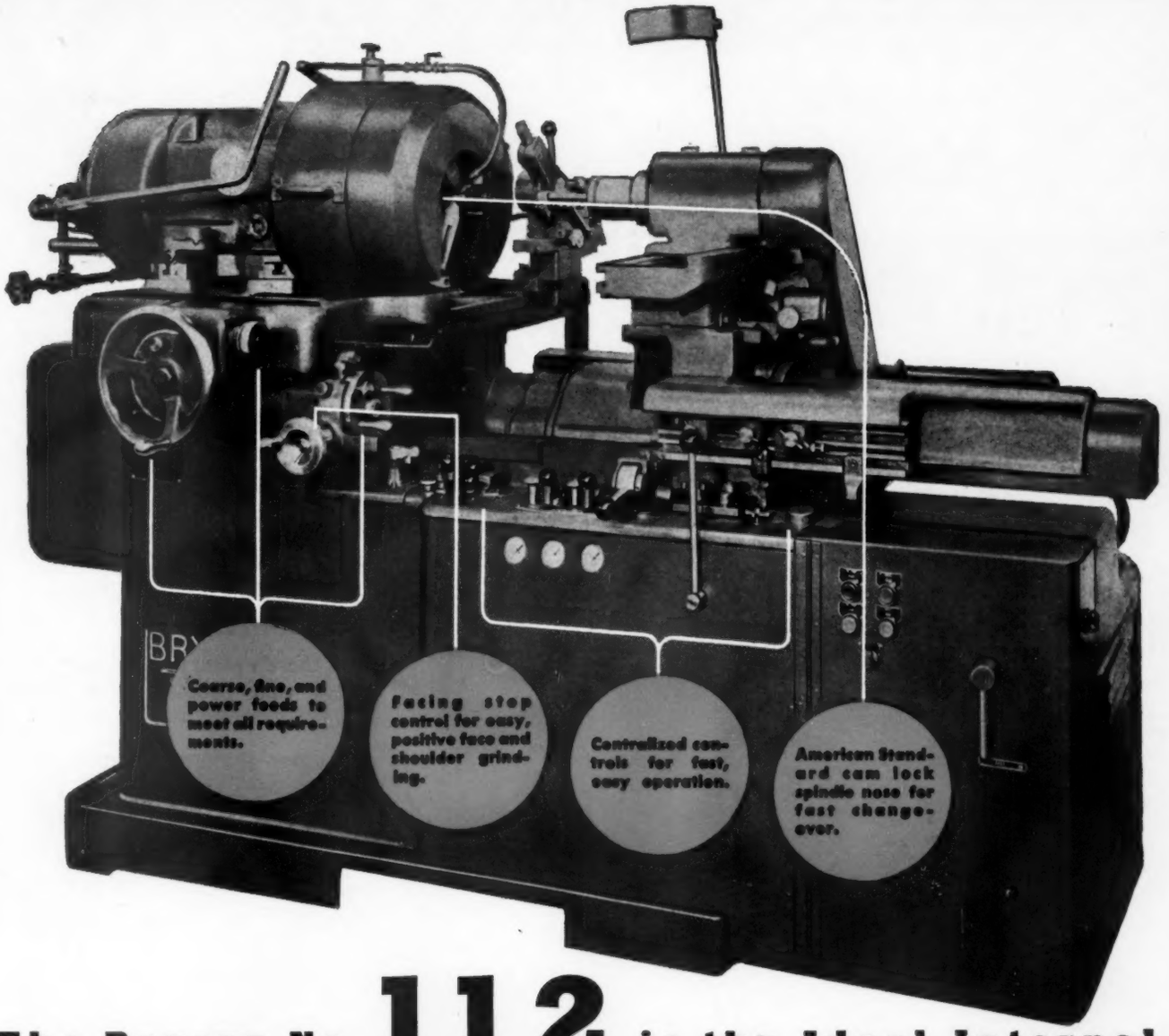
DIVISION OF ARMCO

RUSTLESS IRON AND STEEL DIVISION

The American Rolling Mill Company

BALTIMORE 13, MARYLAND

SALES OFFICES AND DISTRIBUTORS IN PRINCIPAL CITIES


Coarse, fine, and power feeds to meet all requirements.
Facing stop control for easy, positive face and shoulder grinding.
Centralized controls for fast, easy operation.
American Standard cam lock spindle nose for fast change-over.

The BRYANT No. 112 is the Ideal Internal GRINDER for Small Lot Production

From stem to stern, the Bryant No. 112 Internal Grinder is designed for small lot production. It is truly the *ideal* tool room machine, because every lever, every control, every part was planned to speed the production of short runs or single parts.

There are three feed controls—one for coarse feed for setup, another for power feed for production, and a third for fine feed for precision.

An American Standard cam lock spindle nose allows fastest change of chucks and holding fixtures.

All controls are centrally located so that all of the operator's motions are easy and natural—more work produced with less fatigue.

A universal facing stop (standard equipment) makes face and shoulder grinding an easy, positive operation.

These are only highlights—for complete details on this "ideal" tool room internal grinder, just . . .

Send for the Man from Bryant.

Write for new catalog on the No. 112

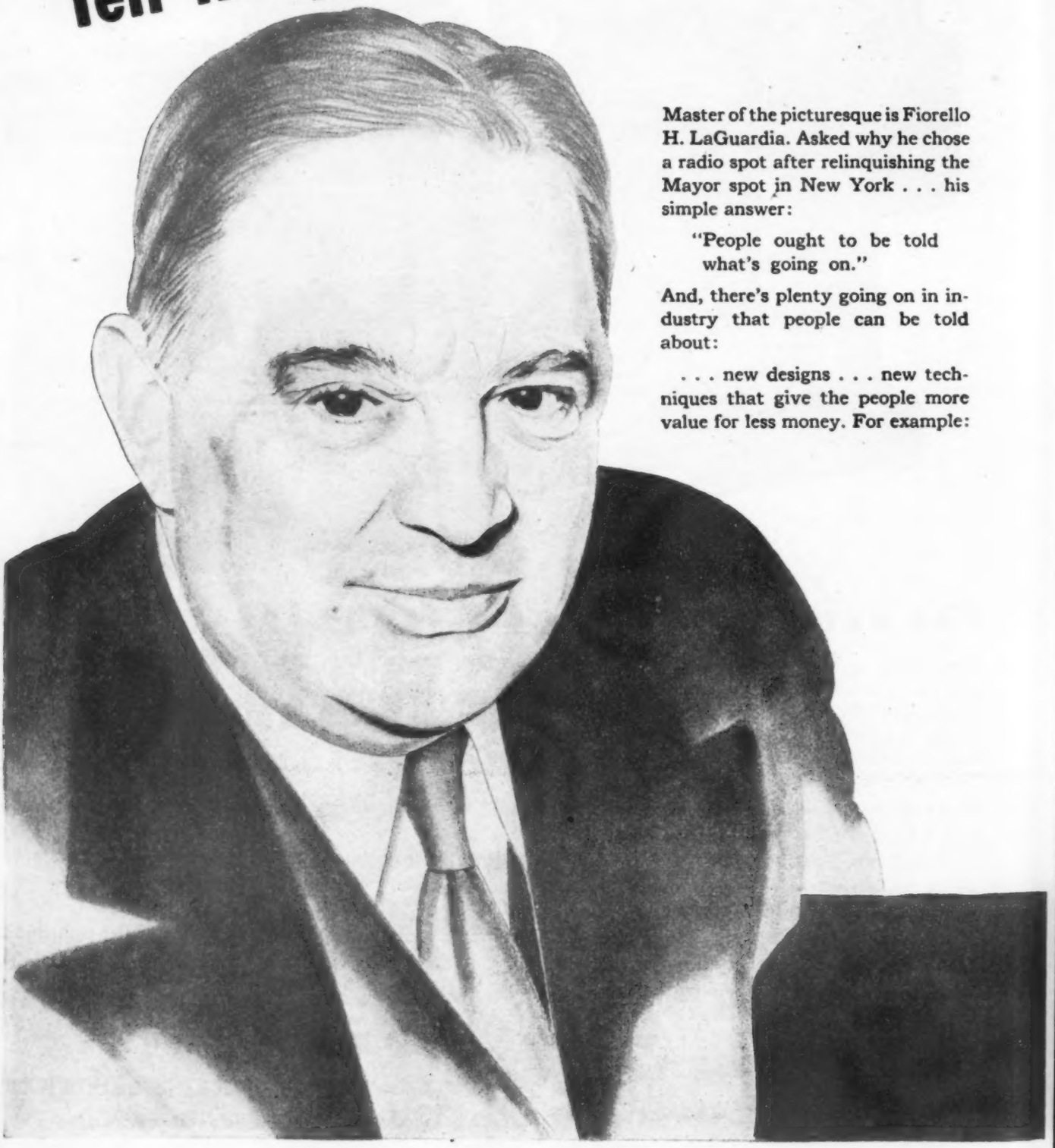
BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

then he said to himself:

Tell the people what's cookin'



Master of the picturesque is Fiorello H. LaGuardia. Asked why he chose a radio spot after relinquishing the Mayor spot in New York . . . his simple answer:

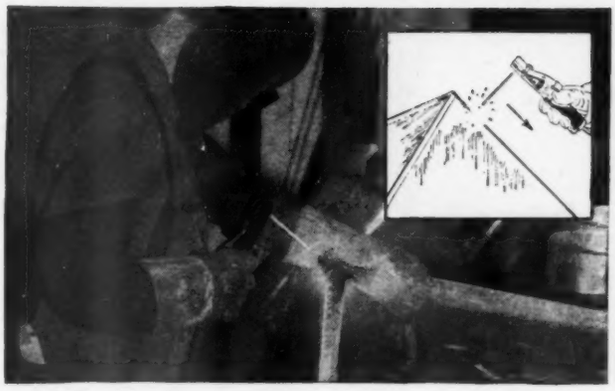
"People ought to be told what's going on."

And, there's plenty going on in industry that people can be told about:

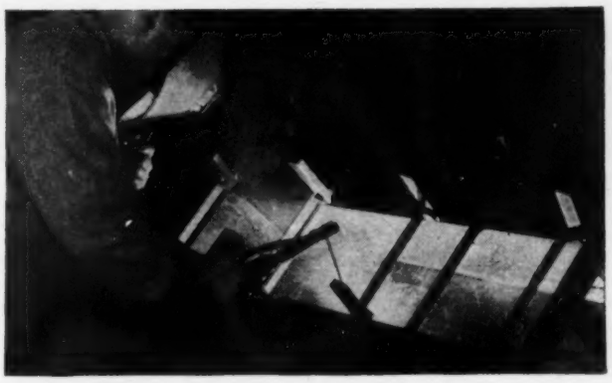
. . . new designs . . . new techniques that give the people more value for less money. For example:

LOOK, MR. LA GUARDIA, how manufacturers are stepping out in front with the world's leading welding electrode:

"Cooking" with *Fleetweld*...



Going downgrade 33% faster. This fabricator was welding corner joints in 18 gauge galvanized steel at an arc speed of 30" per min. At the suggestion of the Lincoln Engineer, he started tilting the joint 45° and welding downhill with "Fleetweld 35". Increased speed to 40" per min. . . . 33% faster.



Jigging up for 16% lower cost. Use of jigs to improve fit-up of parts and positioners to get downhand welding usually permits use of larger electrodes. In welding of this tapping machine frame, electrode size went from 5/32" to 3/16" "Fleetweld 7". Welding cost went down 16%.

Using "arc force" to boost speed 20%. Fillet welds in flat and horizontal positions are being made with ¼" "Fleetweld 11" and "Fleet-Fillet" Technique at arc speeds of 12" per min. where former method gave 10" per min. This mining machine transmission case is a typical application. Full details in Bul. 444.

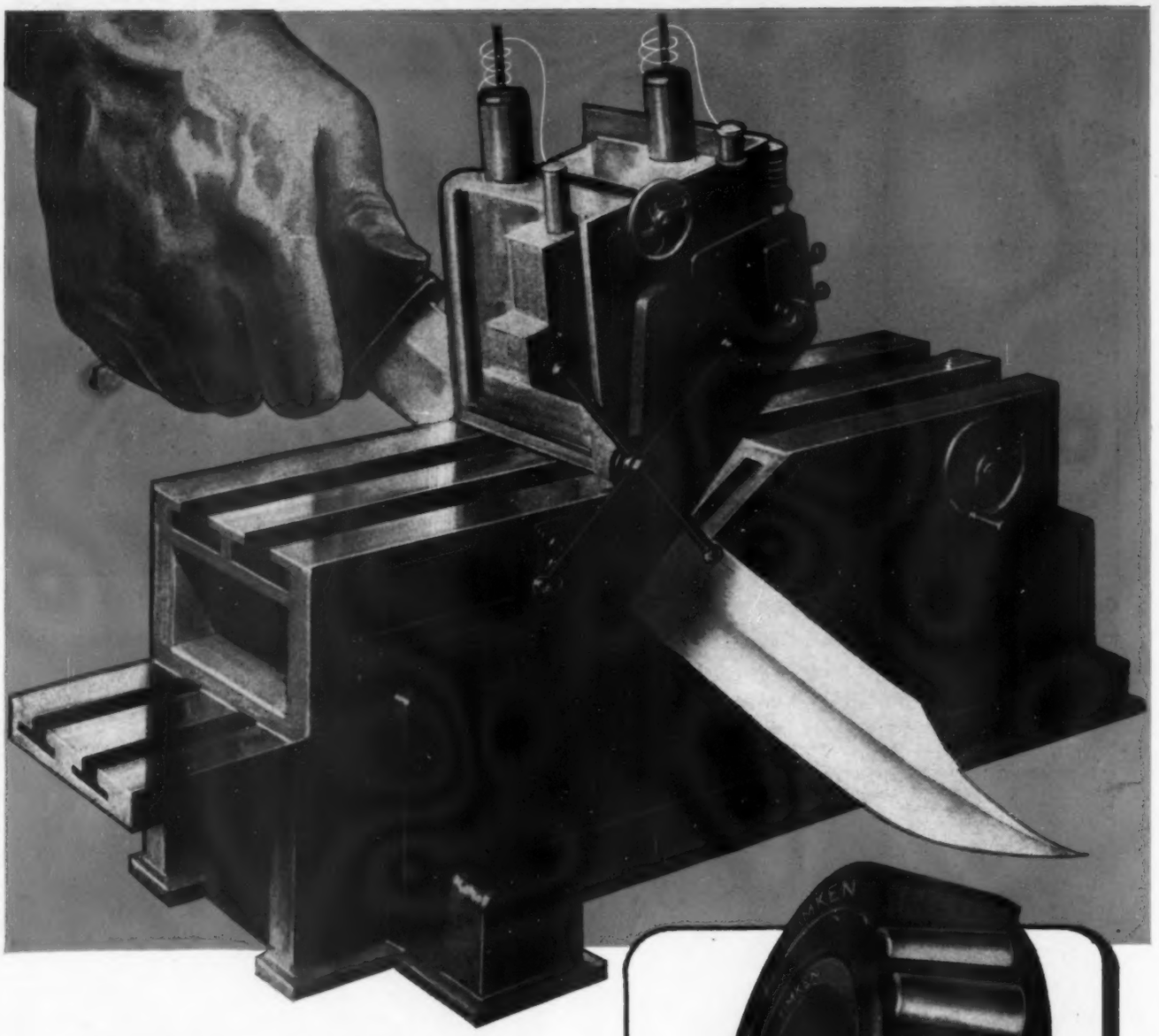
The sign of good "cooking". When you see 3 DOTS on an electrode, you know you have genuine "Fleetweld" . . . the world's leader for *low cost*, *speed* and *quality*. New, handy pocket manual giving procedures for all kinds of jobs free on request. Ask for Bul. 437.

New Lincoln sound-color movies available free for showing to groups. Write for information.

THE LINCOLN ELECTRIC COMPANY • DEPT. 292 • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING



Don't cut the life of your machinery!

The operating life of any piece of mechanism rests largely on the quality of its bearings. That is why practically all of the leaders in most every industry in America have standardized for years on Timken Bearings. They know from long practical experience that this tapered roller bearing is so designed and made that it is in a class by itself.

Timken Bearings are recognized throughout the world for their uniformly high quality and rugged characteristics. Timken Bearings prolong machine life. To be assured of getting the genuine, see that the trade-mark "TIMKEN" is on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio.

"All There Is In Bearings"

COPYRIGHT 1946 BY THE TIMKEN ROLLER BEARING COMPANY

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

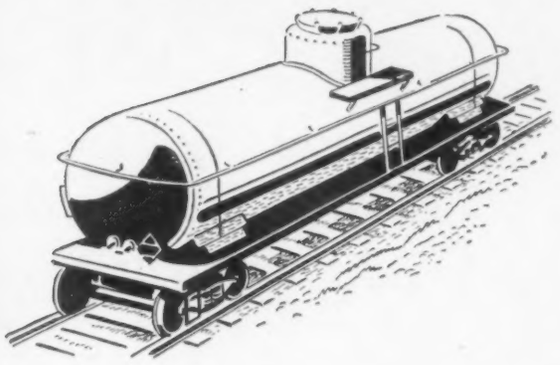
Timken Bearings, Timken Alloy Steels and Tubing and Timken Removable Rock Bits

About 50 all-aluminum tanks for tank cars are now being built by General American Transportation Corporation.

An automatic Lincoln "Electronic Tornado" carbon-arc welds the inside longitudinal seam of the shell structure, at a speed of 12 inches per minute.

Welding the tank dome manually using Alcoa 53 coated electrodes with a metallic arc.

They're *Welding* All-Aluminum Tank Cars



Aluminum tank cars are now a "production" item. About 50 are being built or are on order by General American Transportation Corporation of Sharon, Pennsylvania. And speeding that production is Lincoln Electric Company's "Electronic Tornado" automatic carbon-arc welding machine.

Each shell—31 feet long by 78 to 87 inches in diameter—is made up of ½-inch and ⅝-inch Alcoa Aluminum plate. Alcoa Alloys are used because of their superior performance in the presence of the chemicals to be hauled in these cars.

Whether you've a question on *how* to employ aluminum to best advantage, which fabricating methods to use, or what alloys, Alcoa can help determine the answers. For such assistance, call the nearby Alcoa office, or write:

ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

Welding tube sections at the Reznor plant

1500% INCREASE in OUTPUT

Eight of these tubes are welded every minute

. . . made possible by electronically controlled resistance welding . . .

Heat-exchanger tubes are now produced by the Reznor Manufacturing Co., Mercer, Pa., at *16 times* the former rate, using seam welding.

While one operator could produce only *30* tubes an hour by gas welding, he can now complete *480*—or a total of 45,000 inches of weld.

This is just one striking example of the boosts in output possible with seam welding.

Why ELECTRONIC Control Was Chosen

Basically a fast process, seam welding is speeded up even more by electronic control. With this type of control it is possible to interrupt the welding current consistently up to 1800 times in a *single minute*.

Equally important is the fact that electronic seam-welder control, with its synchronous-precision timing, helps assure high-quality welds.

Electronic control is quiet operating, too. The welding current is controlled by noiseless electronic tubes. And because there are no contacts to replace, maintenance cost is low.

If you'd like more information about electronic seam-welder control, ask our local office for a copy of Bulletin GEA-4220. Our engineers will be glad to help you with your application. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

REDUCED KVA DEMAND

This electronic seam-welder panel used in the Reznor plant offers an additional advantage—it is designed for use with series capacitors to provide power-factor correction. This combination makes possible a material reduction in demand on the power supply—an important saving in all industries.

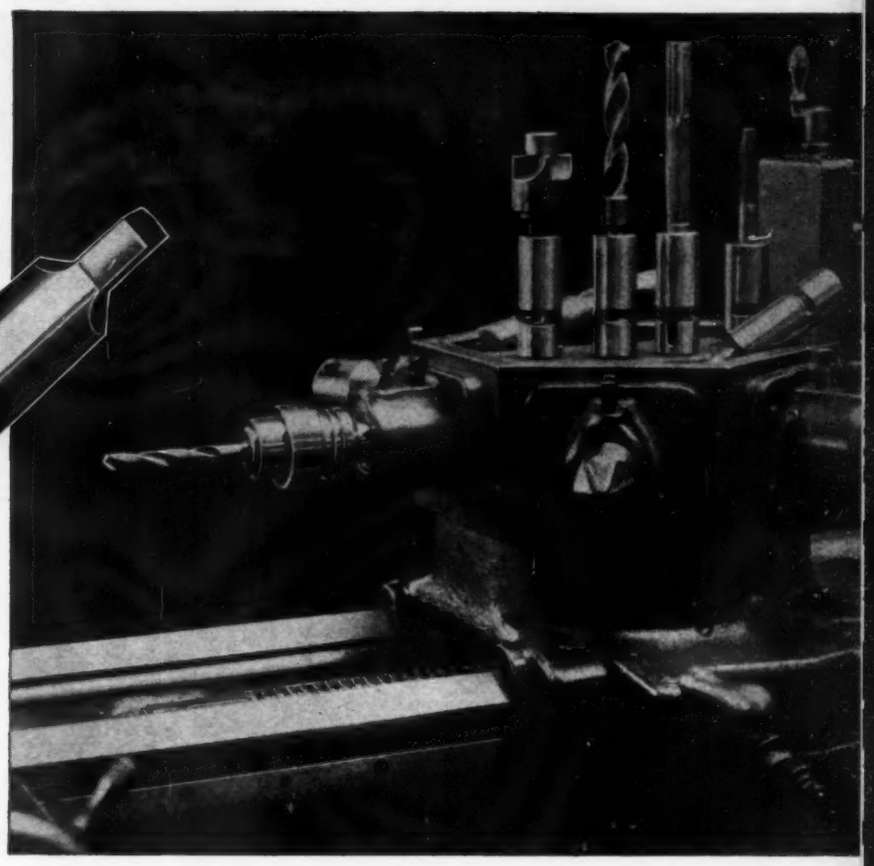
G-E RESISTANCE WELDING CONTROL

GENERAL ELECTRIC

. . . need extra turret lathe stations?

Make them available with

MODERN-MAGIC CHUCK and COLLET EQUIPMENT

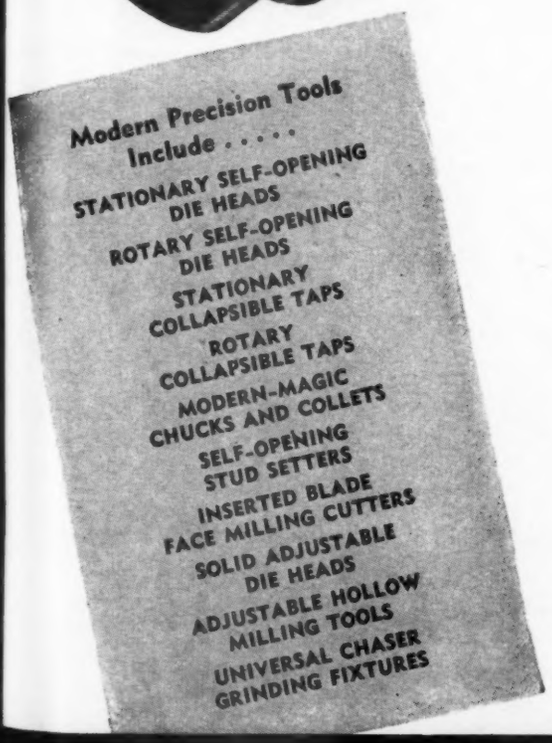


Modern-Magic Quick Change Chuck and Collet Equipment has repeatedly proved its value to turret lathe operation where there are not enough openings in the turret to accommodate all the necessary tools for the job.

In effect, Modern-Magic Quick Change Chuck and Collet Equipment makes available as many extra turret stations as are needed. The tools being inserted and removed, one after the other, to take care of each extra operation.

With Modern-Magic Quick Change Chuck and Collet Equipment, tool changes are quickly and easily made. Production is stepped-up and cost reduced.

For complete information covering Modern-Magic Quick Change Chuck and Collet Equipment, send for Bulletin No. M-101


Modern Precision Tools Include . . . . .
STATIONARY SELF-OPENING DIE HEADS
ROTARY SELF-OPENING DIE HEADS
STATIONARY COLLAPSIBLE TAPS
ROTARY COLLAPSIBLE TAPS
MODERN-MAGIC CHUCKS AND COLLETS
SELF-OPENING STUD SETTERS
INSERTED BLADE FACE MILLING CUTTERS
SOLID ADJUSTABLE DIE HEADS
ADJUSTABLE HOLLOW MILLING TOOLS
UNIVERSAL CHASER GRINDING FIXTURES

Prompt shipment from stock

MODERN TOOL WORKS

DIVISION OF

CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

BORE · CHAMFER · FACE IN *Selected Sequence* FOR ACCURACY AND PROFIT

Do three operations simultaneously, automatically, accurately—*and profitably.* This Cross Automatic bores, chamfers, and faces the clutch housing after assembly with the cylinder block. However, its utility isn't restricted to this cost reducing cycle.

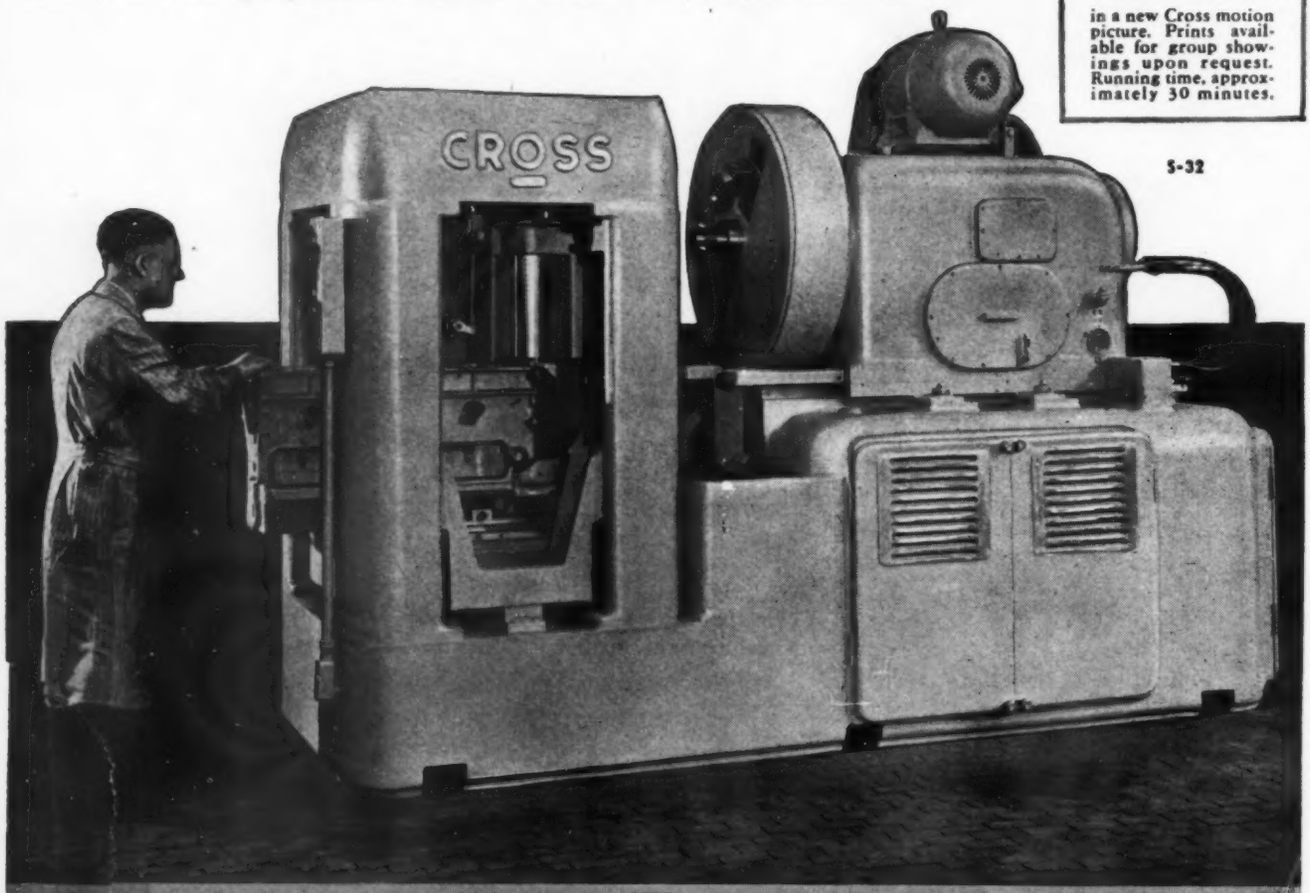
Another very desirable, and practical, alternate automatic cycle is also incorporated in this machine; for additional flexibility. When this cycle is engaged, these same operations can be done independently, including automatic reduction of the spindle speed when the boring cut ends and facing begins. Choose the cycle you prefer.

"Selected Sequence" may be your password to profit.

LOWELL THOMAS Tells the Story of TOOLS for PROFIT

in a new Cross motion picture. Prints available for group showings upon request. Running time, approximately 30 minutes.

S-32



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ESTABLISHED 1898

SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • PRECISION BORING • TURNING • GRINDING • CHAMFERING

DETROIT 7, MICHIGAN

Send for Bulletin No. 55

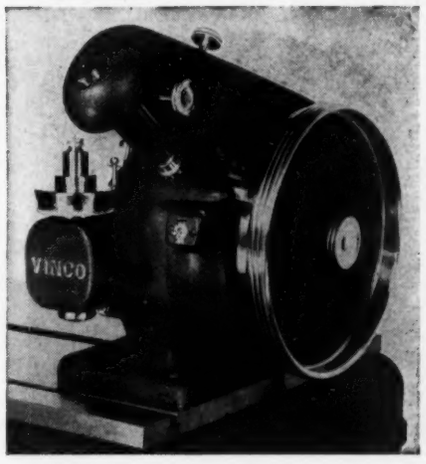
30 Times MORE ACCURATE

What does that mean to you? It means that this proven accuracy is available to you for the inspection of gear teeth, master index plate notches, splines, cams and any other form of angular spacing. It means that final assemblies involving gears, cams, splines, etc., will be subject to less scrappage, because angular spacing errors will have been found and corrected.

Vinco guarantees the OPTICAL MASTER INSPECTION DIVIDING HEAD to be accurate within two seconds of arc; the master disk graduations to be spaced to an accuracy within ONE SECOND of arc; and the ball bearing spindle runout to be within TWENTY-FIVE MILLIONTHS of an inch, total indicator reading (the majority of spindles have less than fifteen millionths runout).

The fact that the VINCO OPTICAL MASTER INSPECTION DIVIDING HEAD has become firmly established throughout industry in such a short time is proof of its dependability and industrial necessity. The following pages cite one of many actual cases where the VINCO OPTICAL MASTER DIVIDING HEAD played a vital role in the production of a toothed part.

Below is the dividing head proper, showing the micrometer, scope, and hand wheel.



MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

They Came to

Check These Against Your Present Needs

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Roller Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

VINCO

BECAUSE THEY WERE STUMPED BY A REAL "TOUGHY"

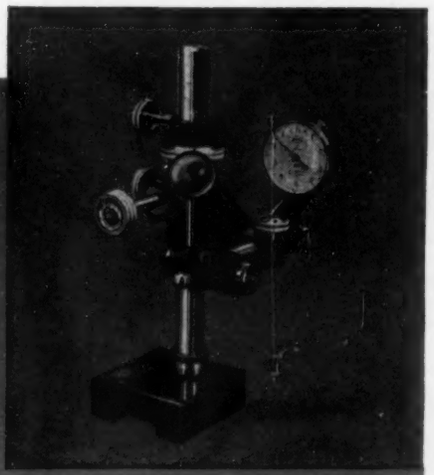
It wasn't unusual! This group of production engineers, representing a large eastern manufacturer, had used our precision production service before and were well acquainted with Vinco methods and Vinco results.

Their request was not an ordinary one however! We were asked to produce, in quantity, mating toothed parts with 18 slots, each slot .017″ in width with a tolerance of .0003″ and a root diameter held to a uniformity of .0001″.

These parts were produced exactly as specified and were delivered on time and in quantities over and above specified requirements. We cite this one instance only because it is informative. Our long experience in the production of precision instruments and finely finished gages has given us a decided edge on precision production methods and techniques. Equipment and machines of our own design and make, in the capable hands of highly skilled operators, an engineering force thoroughly grounded in every phase of precision design and construction and a sales organization made up of men who combine a full engineering background with a wide and intimate knowledge of the trends and developments in the industrial field are all valid reasons for a further inquiry regarding this important phase of modern production.

Precision parts by Vinco meet your specifications. Give us the chance to prove it.

The Vinco Standard Indicator Surface Gage



Features of this gage include a .0001″ custom built, full jeweled, dial indicator—differential adjusting screw for final settings—1½″ to 12″ work height range—full 360 degree swing of indicator head—readings can be taken on upper or lower surfaces.

Extreme accuracy and flexibility of operation all combine to make this standard indicator gage practically indispensable wherever rapid and close inspection of surfaces is required. (Incidentally, it was used regularly for checking the job mentioned above.) We designed these indicator gages for use with the Vinco Optical Master Inspection Dividing Head, but because of increasing requests they are now offered for general sale.

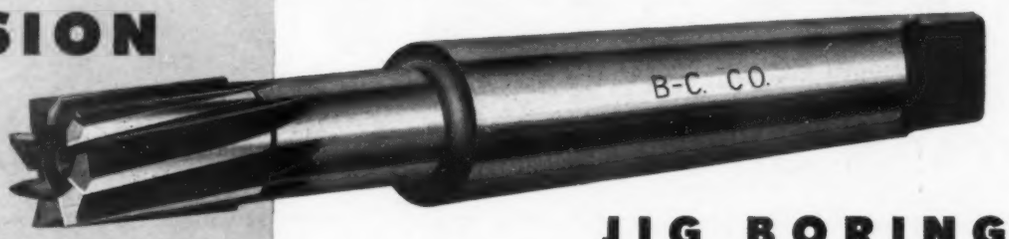
Vinco Universal Dividing Head

Developed by Vinco to handle light machining or grinding, this universal dividing head played a vital part in the manufacture of the "toughy". A ratio of 1440 to 1 between handle and work spindle provides an extremely high degree of spacing accuracy, even when using standard commercial dividing head plates.

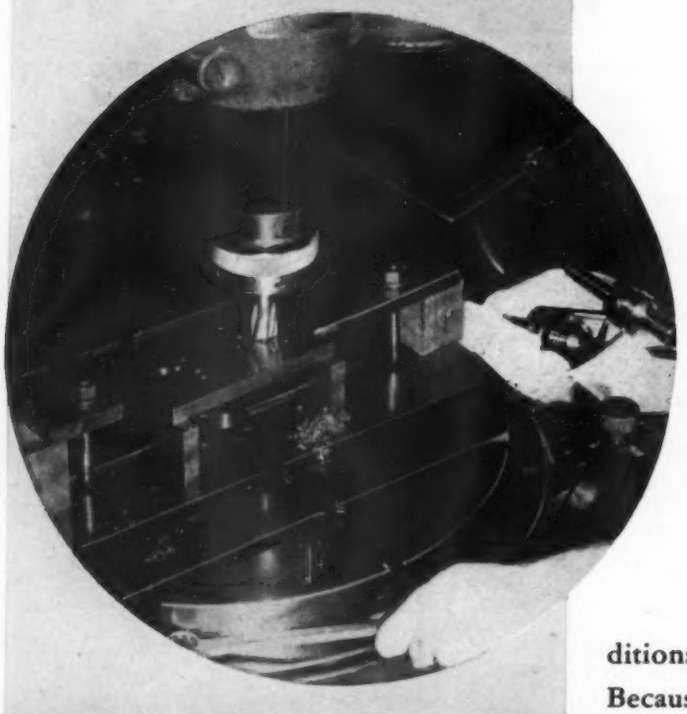
The dividing head can be mounted either vertically or horizontally. It features a large diameter spindle mounted in a double row of Vinco designed ball bearings, a tapered spindle nose for work adaptors, a face plate of 11″ diameter, a graduated dial on the spindle for initial settings, an auxiliary resetting dial and a 11.459″ pitch diameter helical gear index plate with 360 accurately spaced teeth.

BARBER-COLMAN

PRECISION



JIG BORING REAMERS



BARCOL Precision Jig Boring Reamers, available from stock with either tang drive or tapped for drawbolt, are produced with the same master craftsmanship found in all other Barber-Colman Small Cutting Tools. Tolerances within .0001″ are held relative on all ground surfaces, and each reamer is individually finished with a smooth highly polished grind. A specially developed B-C tooth form is applied and so closely are these reamers machined and heat treated that they will hold hole sizes within .0002″ if machine conditions are equal to the accuracy of the reamers. Because of these precision qualities Barcol Jig Boring Reamers have often produced single-point boring results, and at a fast rate of production. For consistent accuracy, greater efficiency and lower tool cost equip your Jig Boring Machines with Barcol Precision Jig Boring Reamers.

1. Tooth design minimizes chip congestion and promotes free cutting action.
2. Deep counterbore permits resharpening many times, providing extra tool life.
3. Maximum cutting efficiency afforded through scientifically developed clearances.
4. Maximum wear qualities through advanced heat treating methods and specially selected steels.

Write for Booklet

Send for a copy of new bulletin F-2434 containing sizes and prices of Standard Barcol Jig Boring Reamers.

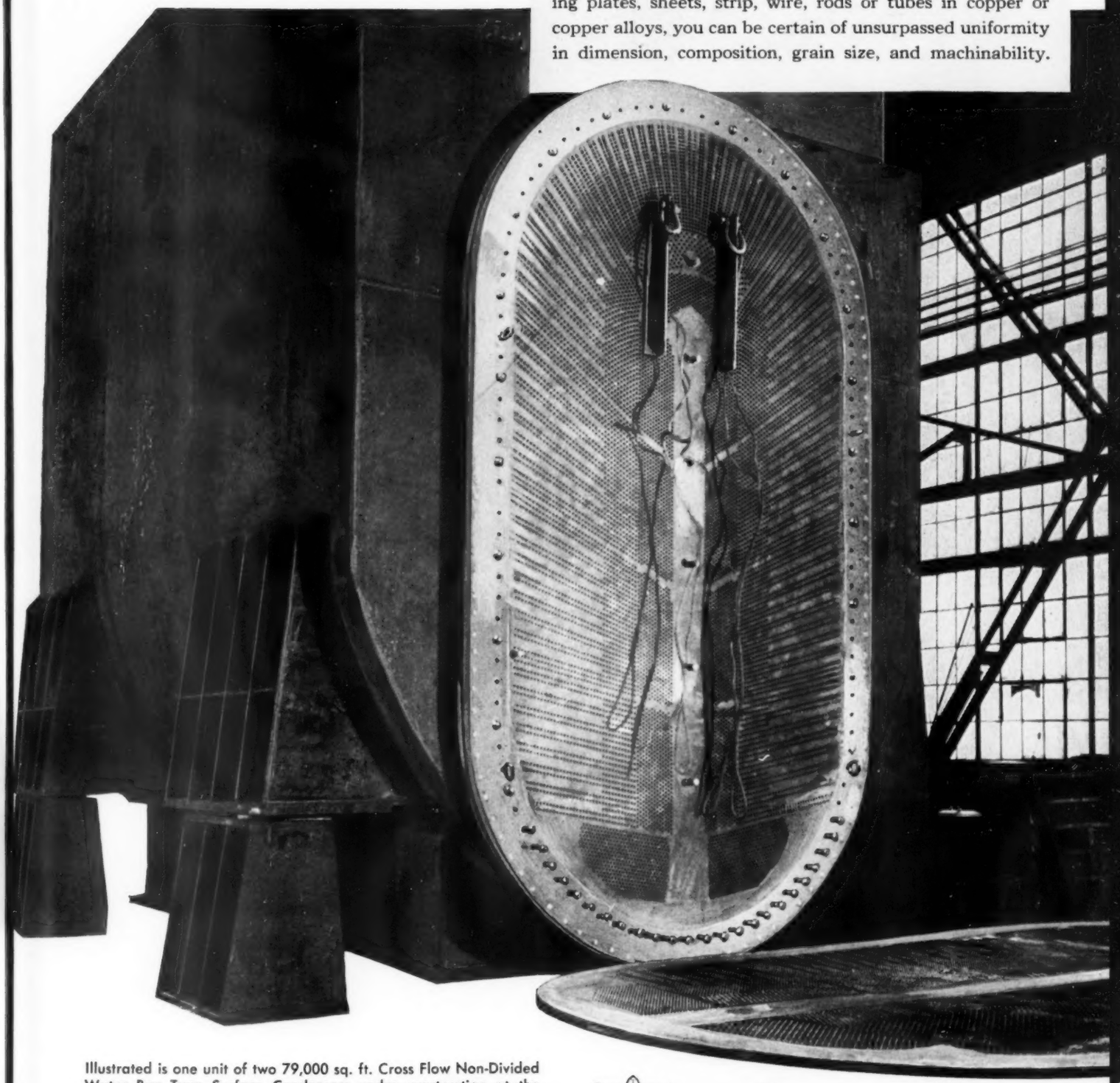
BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

An unusual job, these 14,000-pound Anaconda Muntz Metal Plates

But . . . you can expect the unusual in brass mill performance and technical cooperation from The American Brass Company. Furthermore, by specifying "Anaconda" when ordering plates, sheets, strip, wire, rods or tubes in copper or copper alloys, you can be certain of unsurpassed uniformity in dimension, composition, grain size, and machinability.



Illustrated is one unit of two 79,000 sq. ft. Cross Flow Non-Divided Water Box Type Surface Condensers under construction at the Carteret, N. J. Plant of the Foster Wheeler Corporation for installation at the Southwark Electric Generating Station of the Philadelphia Electric Co. The 1-1/2"-thick Anaconda Muntz Metal Tube Plates, measuring 11'7" x 21'1" and weighing approximately 14,000 pounds each, were supplied by the Detroit Branch of The American Brass Company. 12,316—27/32" tube holes and 108—1-5/8" bolt holes were drilled in each plate. See the following page.

ANACONDA
from mine to consumer

Anaconda

COPPER & COPPER ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

talking about the machinability of Brass...

Depth of hole, 3″
Drill Size, 27/32″
Speed, 2200 r.p.m.
Feed, .015″

Drilling Time
6 SECONDS!

See the preceding page for a description of these 14,000-pound Anaconda Muntz Metal (60% copper – 39.5% zinc – 0.5% lead) Condenser Tube Plates. The photo below was taken in the shops of Foster Wheeler Corporation.

The 1-1/2″-thick plates were clamped together for drilling 12,316–27/32″ matched tube holes. Yet, so uniform was the metal in machinability that hole after hole—in all parts of the 11′7″ x 21′1″ plates—was drilled in 6 seconds. 46159

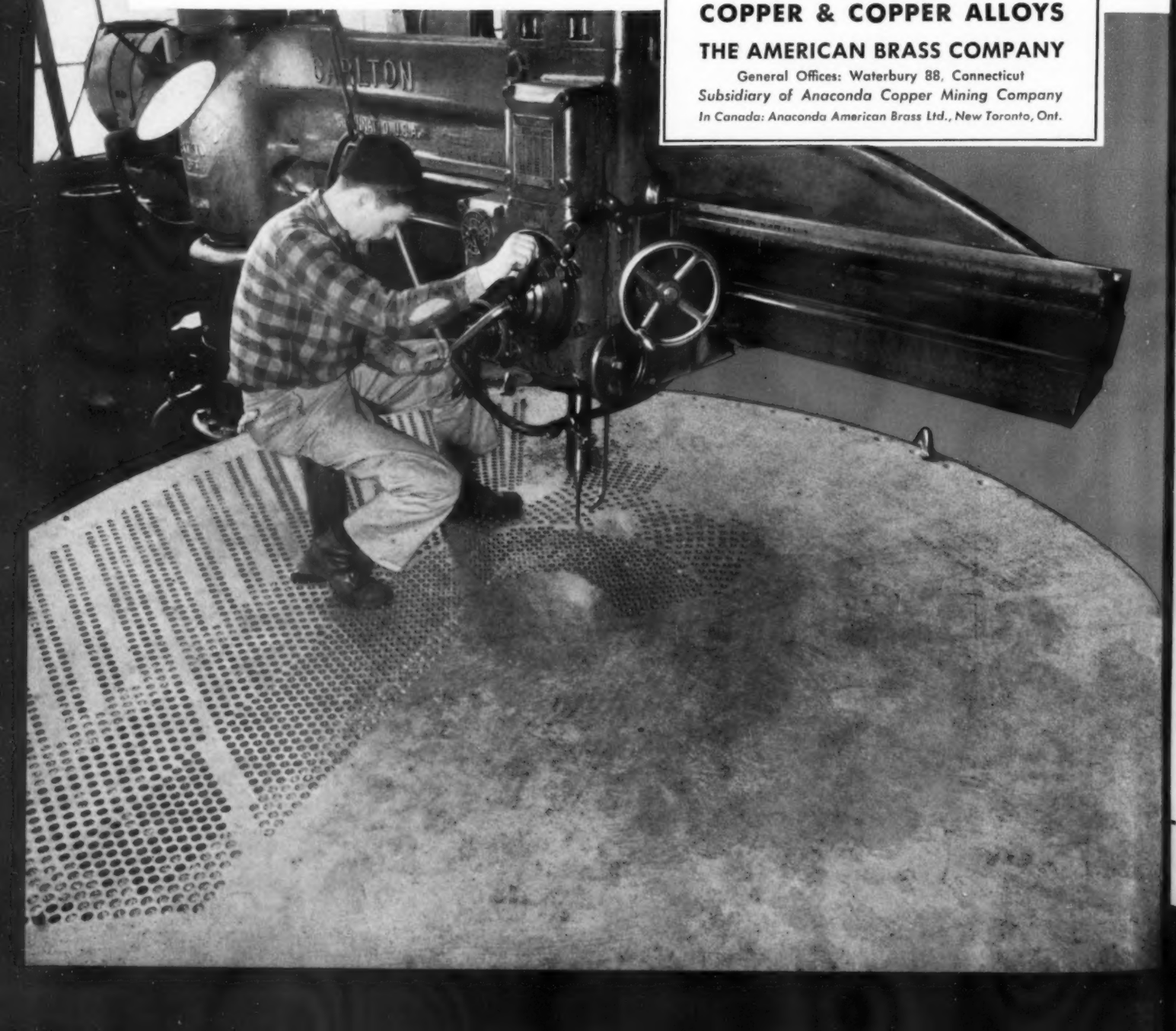
ANACONDA
from mine to consumer

Anaconda

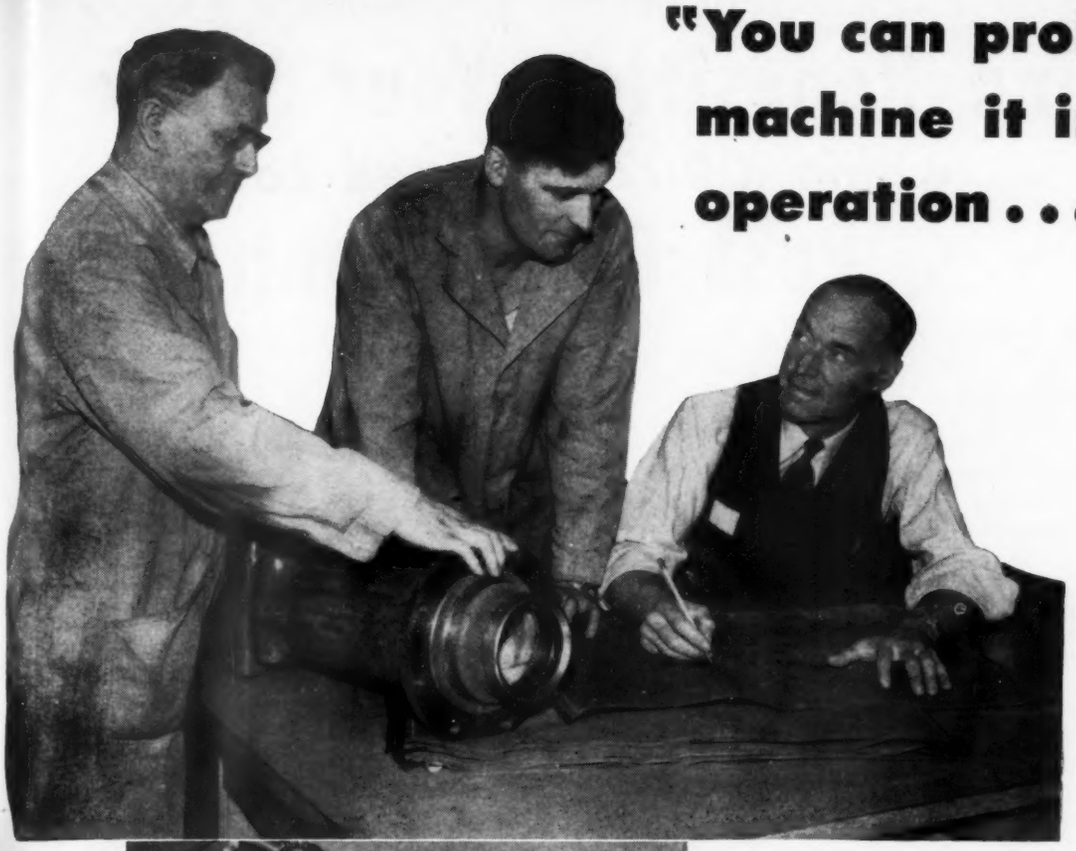
COPPER & COPPER ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



"You can probably machine it in ONE operation . . .

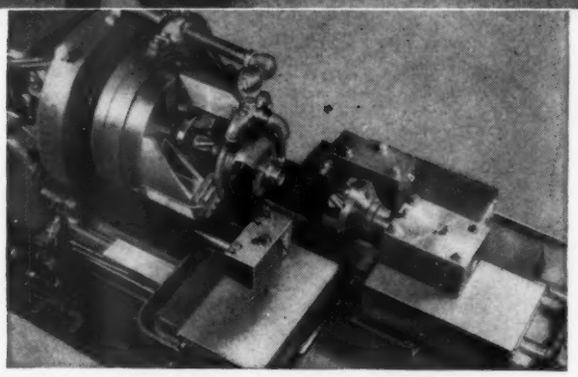


on a Gisholt Simplimatic!"

Surprised? It's not at all unusual for a Gisholt Simplimatic to machine the front and back faces as well as inside and outside portions of a part simultaneously. Twenty to thirty cuts are frequently made at one time on complicated parts, and to close tolerances.

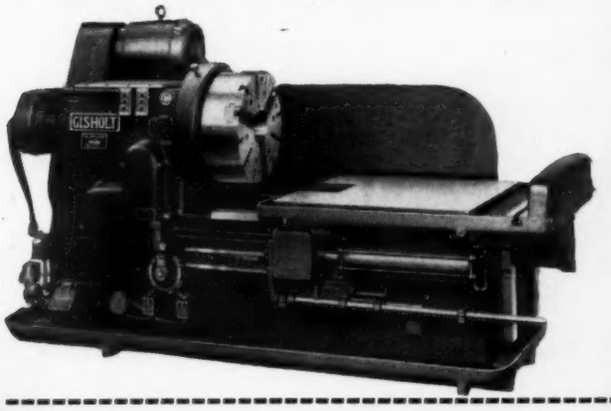
This is because the large platen table of the Simplimatic permits the use of a larger number of slides placed most advantageously with respect to the job the tools are to do. You are free from the usual restrictions.

Gisholt can arrange the tooling and ship you the complete Simplimatic—production tested on your job—ready to work. Send the blueprints and specifications of parts you produce in quantity and learn what this modern automatic lathe can do for you.



FRONT AND BACK—ONE OPERATION. *Two similar sets of tools—one on center slide and the other on a back boring attachment through the spindle—rough drill, turn the outside, face and chamfer hubs on both ends of differential carrier while rear slide turns two diameters and front slide faces outer flange. Cutting time:* 1¼ *minutes.*

TEN TOOLS *finish ten surfaces on this aluminum aircraft engine crankcase in 3 minutes and 10 seconds. One man and two Simplimatics handle the work formerly done by ten men and ten other type machines.*



Look Ahead...Keep Ahead...with Gisholt

GISHOLT

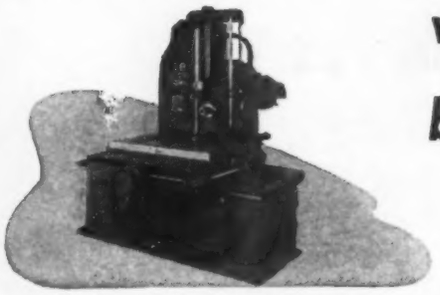
GISHOLT MACHINE COMPANY
1201 E. Washington Avenue, Madison 3, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Retract and Reposition Your Work

within .0002" Selected Location

by Push Button Controls!



3-B DEVLIEG JIGMIL Provides for

Minimum Tool Overhang

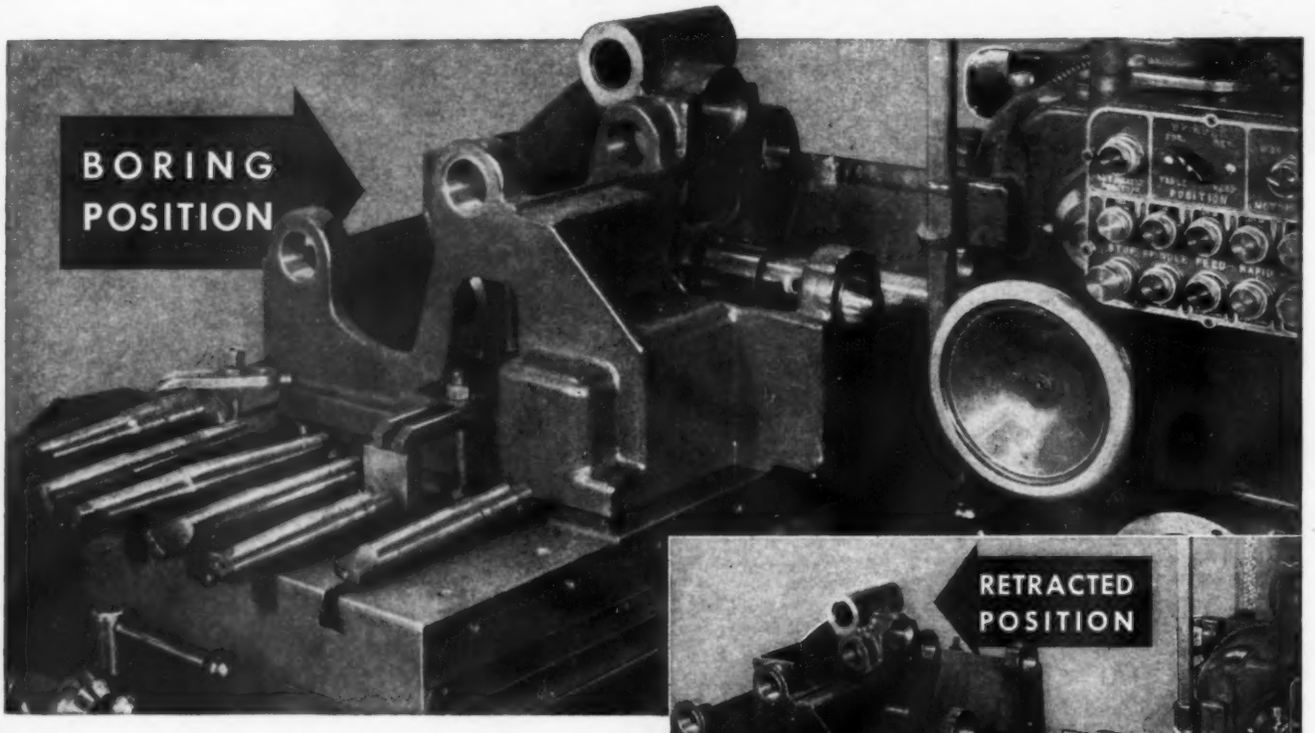
Maximum Operating Efficiency

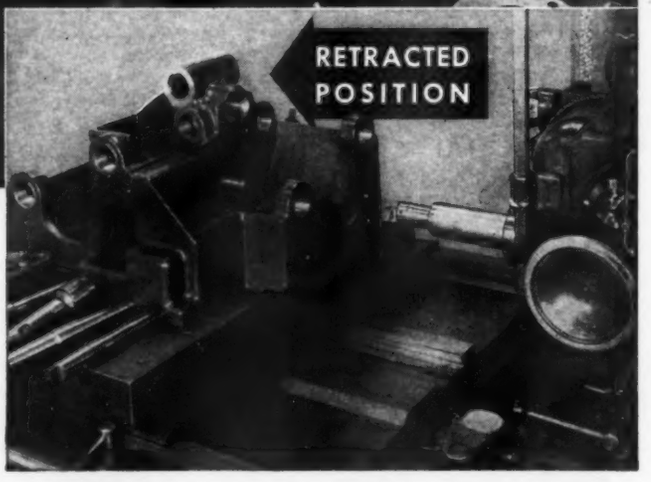
Greater *Controlled* Accuracy

You can save time, cut costs and reach new high standards of accuracy on your difficult precision jig boring and milling operations with a 3-B DeVlieg JIGMIL.

Location of work for minimum tool overhang and top performance advantage! Ready accessibility for necessary tool adjustments and changes! Convenience for checking machined dimensions! All these are served by JIGMIL's centralized push button control means which unlocks and retracts the table to open position, then automatically repositions and locks the table to within .0002" of the selected position.

In addition, JIGMIL's push button controls provide automatic hole spacing accuracy within .0001". Write today for complete descriptive and technical literature.





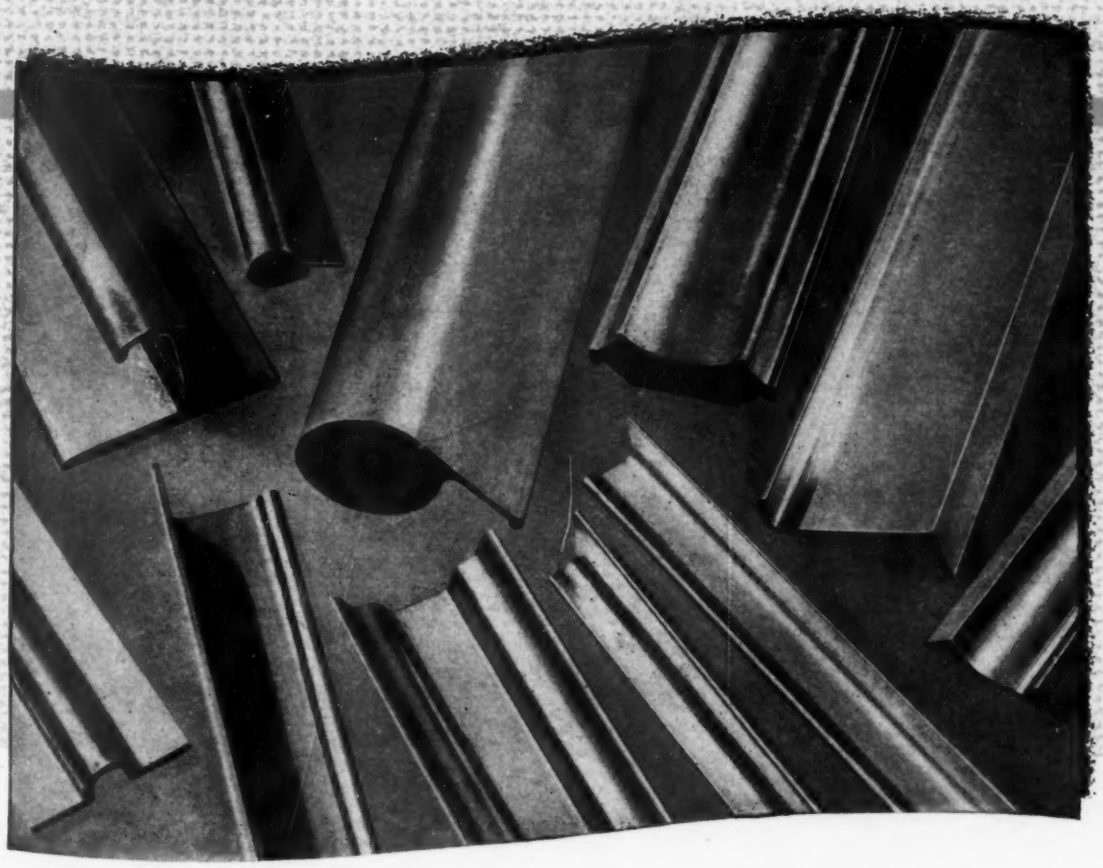
Here's Precision Boring at its Best!

The work piece above is an intricate casting for a three way diamond boring machine. All holes were bored on a 3-B DeVlieg JIGMIL to size, length and spacing accuracies of within .0001". Of the five castings comprising this particular job, the same high JIGMIL standard of accuracy was maintained throughout for perfect interchangeability of parts!

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Dies cost so little . . .

it pays to design your own Magnesium Extruded Shapes



Alcoa's charges for extrusion dies are small; $60 to $150 would pay for the die for any shape shown here (under 3 inches circle size). So, where a standard shape won't do exactly what you require, it'll probably pay to design a special shape that will. You'll quickly absorb that die cost.

Shapes that interlock, or provide extensions for attachment of other parts, save on assembly time. The intricate shapes possible with the extrusion process avoid having to build up complicated assemblies.

Of course, with American Magnesium extruded shapes, you achieve the ultimate in weight saving—most efficient use of the metal, coupled with the featherweight lightness of magnesium. For help in using magnesium extruded shapes to best advantage, call the nearby Alcoa office. Or write:

Aluminum Company of America, Sales Agent for American Magnesium products, 1709 Gulf Building, Pittsburgh 19, Pa.

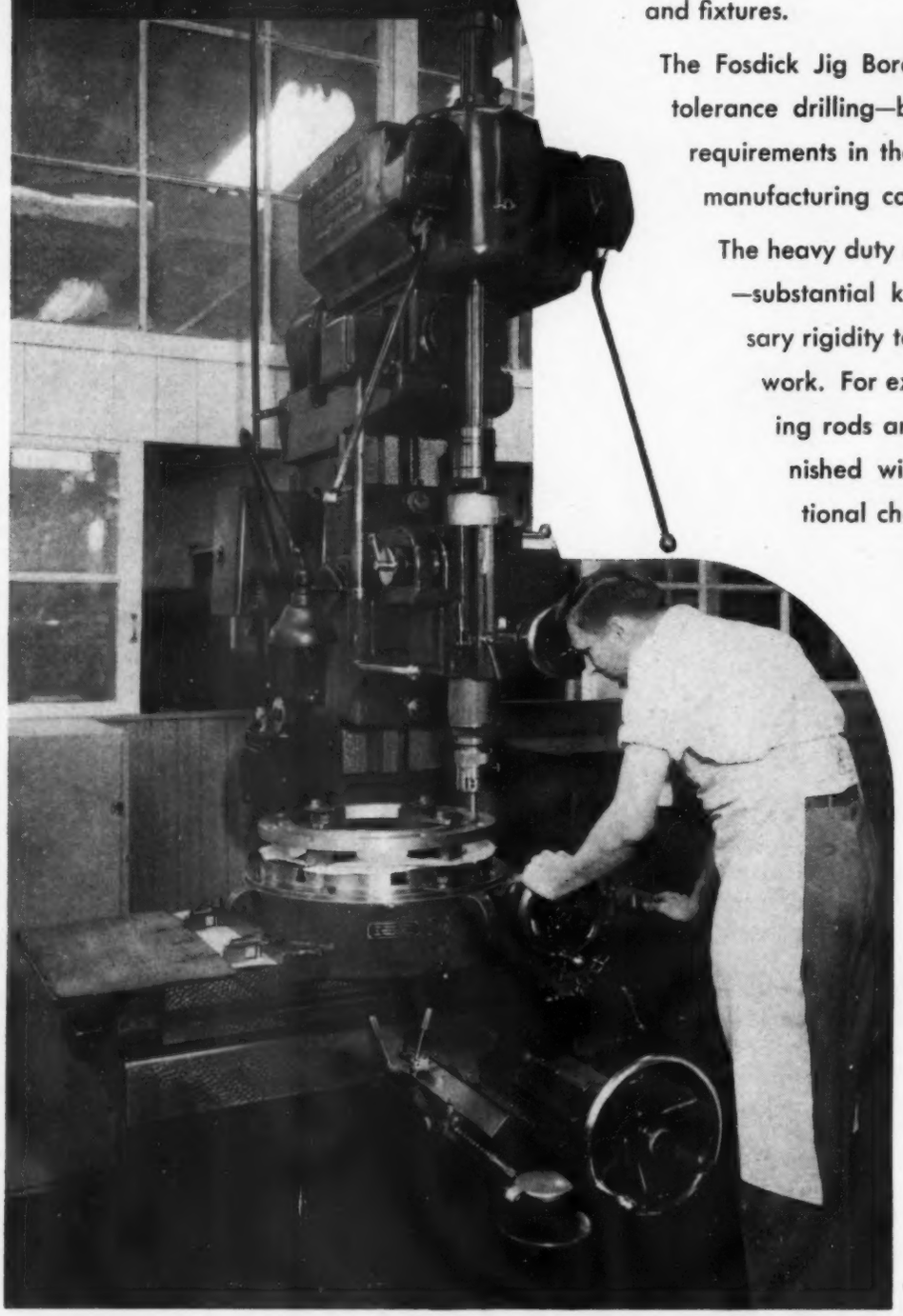
MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

For reducing costs
in your tool room

FOSDICK JIG BORER



● Developed primarily for tool room and tool and die shop operations the Fosdick Jig Borer is also used quite frequently for short runs on production jobs where maintaining definite tolerance limits is essential.

Its adaptability to a wide range of precision operations, at one setting, often eliminates necessity for costly jigs and fixtures.

The Fosdick Jig Borer illustrated is meeting close tolerance drilling—boring—reaming—and tapping requirements in the plant of a nationally known manufacturing company.

The heavy duty column—sturdy spindle support —substantial knee structure provides necessary rigidity to produce consistently accurate work. For extreme precision work, measuring rods and dial indicators may be furnished with the machine for an additional charge.

However its wide adaptability—ease of operation —moderate first cost make it most economical for tool room and tool and die shop operation.

Our Jig Borer Bulletin J. B. A. gives complete information. Ask for your copy today.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

HIGH PRODUCTION

All-Hydraulic Presses

For FORMING

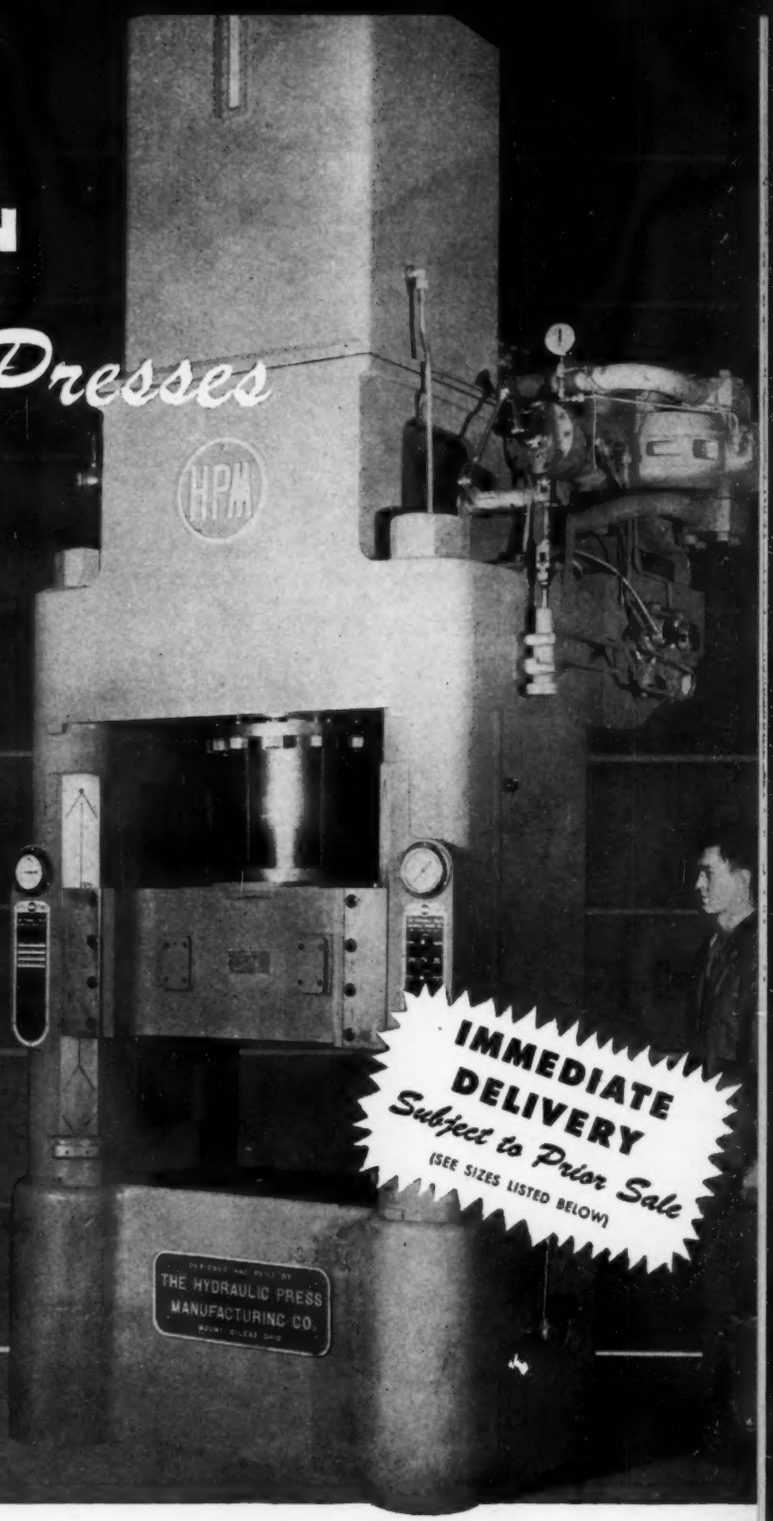
STRAIGHTENING

EMBOSSING

BLANKING

FORGING

COINING



IMMEDIATE DELIVERY
Subject to Prior Sale
(SEE SIZES LISTED BELOW)

Designed for rapid cycling (up to 40 strokes per minute), the H-P-M "All-Hydraulic" press illustrated above is ideally suited to mass production methods involving the use of single action dies. Automatic ram reversal at a predetermined adjustable pressure insures uniform results.

Other operating features include—full pressure capacity throughout the entire stroke, positive overload protection, precision travel control for setting dies.

The "patented" H-P-M Closed Circuit operating system guarantees shockless operation, with positive control of all press actions. Each pump, valve, and control is designed and built by H-P-M for heavy duty service.

Take advantage of the prompt delivery. The number of presses immediately available is limited.

SPECIFICATIONS

Pressure Capacity (Tons)	Pressing Surfaces (L-RxF-B)	Daylight Opening (Max.)	Ram Travel (Max.)	Motor H.P. (Max.)
300	36" x 24"	30"	24"	40
500	36" x 24"	36"	24"	100

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U. S. A.

Branch Offices in New York, Philadelphia, Cleveland, Cincinnati, Detroit, and Chicago. Representatives in other principal cities.

HPM

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

Self Contained Fastraverse
HYDRAULIC PRESSES

NEW DEVELOPMENT IN CONN ROD BALANCING TECHNIQUE BY *Snyder*

Usual procedure is to weigh the conn rod, then place it in the fixture and mill it. In this new Snyder machine, the rod is placed in the fixture and remains there throughout the operation.

Fixture connects with two scales which show the overweight on either end of the rod. Positive end stops for depth of cut are set by means of hand-wheels on which readings are set to correspond with readings on scales.

Pressing the starter button causes automatic clamping of the part in the fixture in fixed location, rapid advance of both milling units against their adjusted solid stops and feeding the milling cutters through the work.

Cutters then retract from the work to starting position, clamps are automatically released and the part hangs freely on the scale rods, giving the operator an immediate and automatic check on accuracy, without removing part from working position.

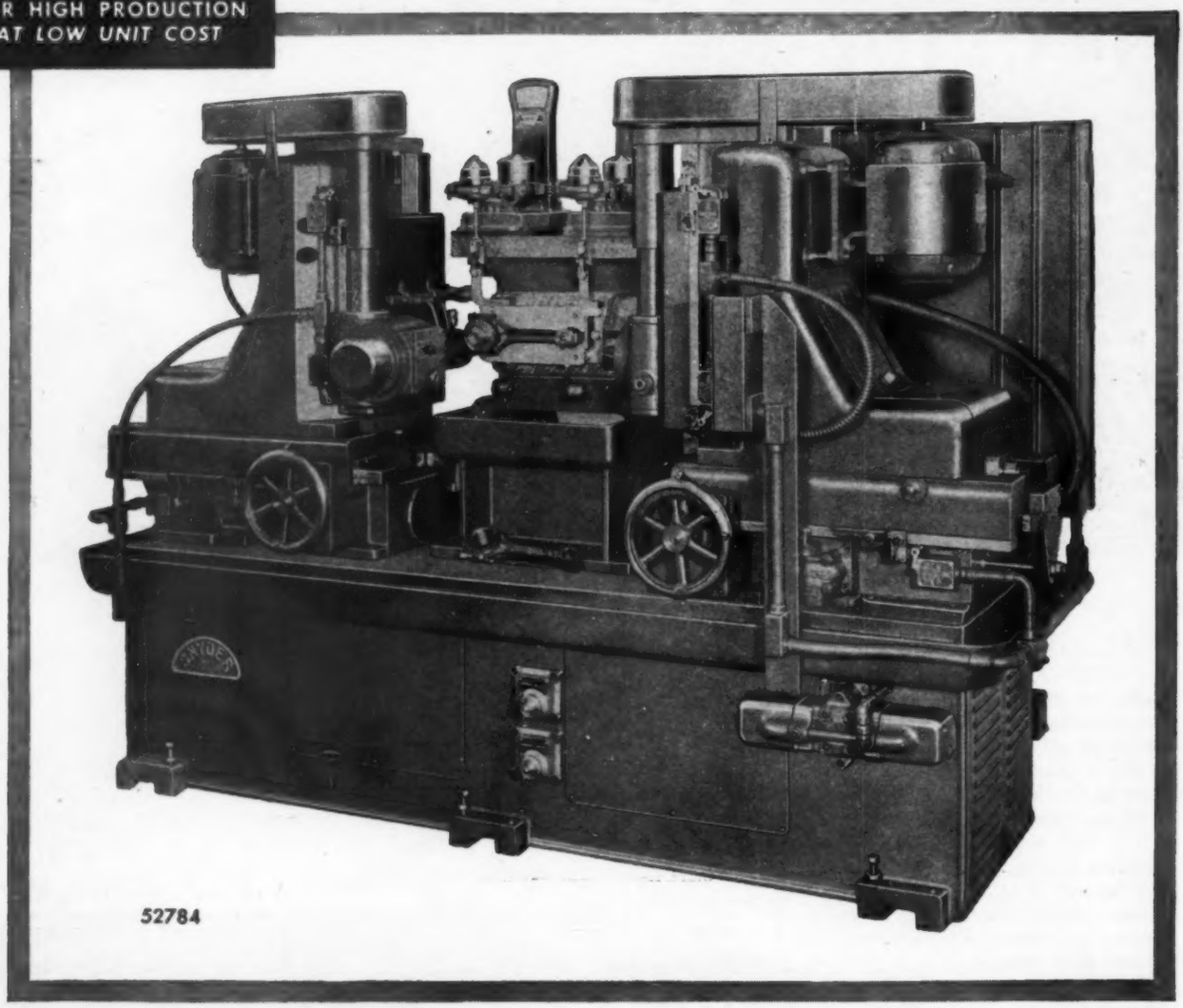
Because one scale is movable and separate fixture adapter and balancing weights are provided for each part, machine can take conn rods from seven to thirteen inches in length. Milling units are adjustable for different rod lengths and for cutter wear.

Production estimates on the basis of an average conn rod are 64 cycles an hour at 80% efficiency.

This machine, designed and built by Snyder, illustrates the effectiveness of a new approach to an old problem. Perhaps there is an old problem in your metal-cutting operations that would benefit from study by Snyder engineers. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

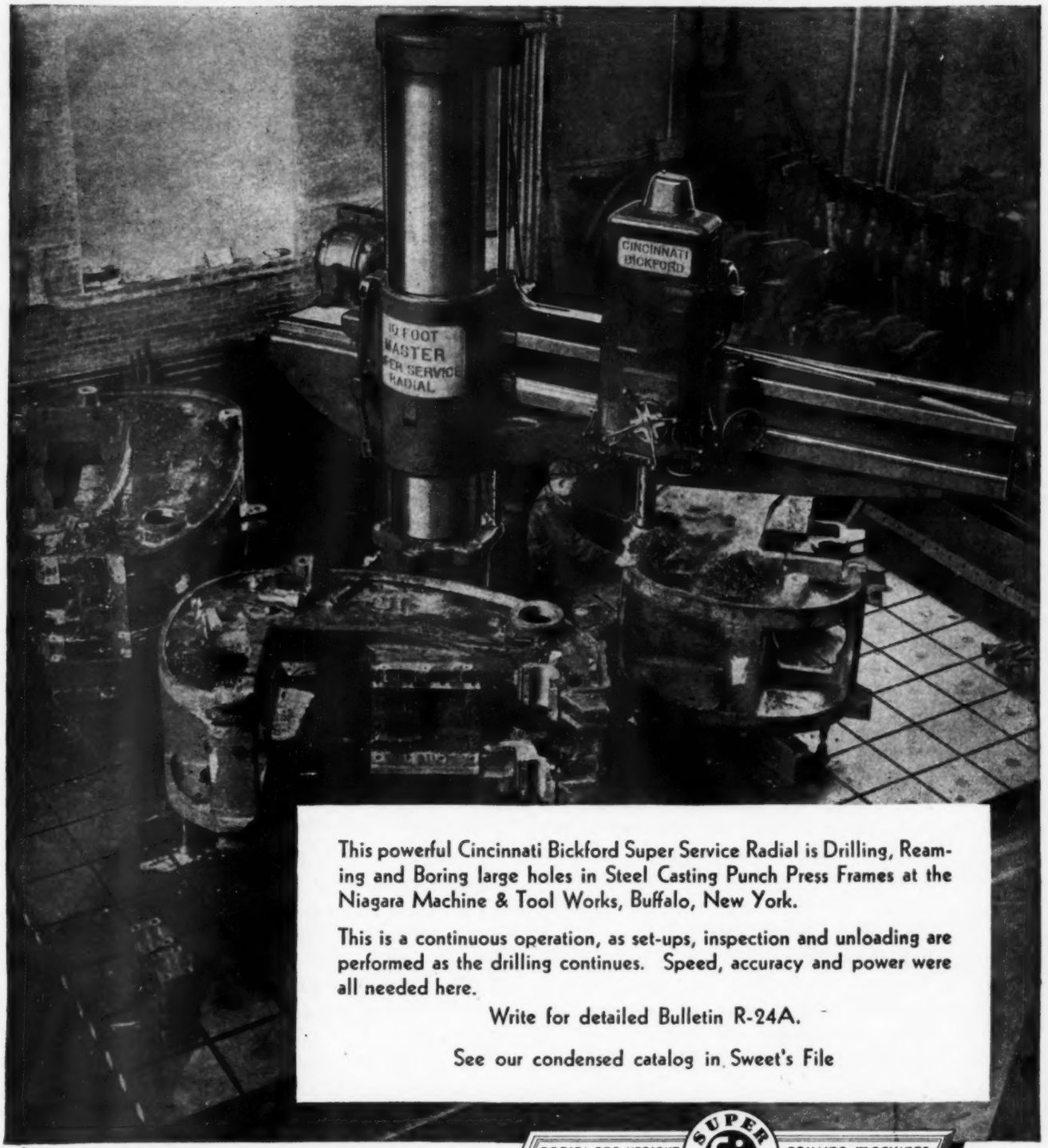
SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries



52784

THE machine TO DO IT . . .



This powerful Cincinnati Bickford Super Service Radial is Drilling, Reaming and Boring large holes in Steel Casting Punch Press Frames at the Niagara Machine & Tool Works, Buffalo, New York.

This is a continuous operation, as set-ups, inspection and unloading are performed as the drilling continues. Speed, accuracy and power were all needed here.

Write for detailed Bulletin R-24A.

See our condensed catalog in Sweet's File

Courtesy of Niagara Machine & Tool Works, Buffalo, N. Y.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Call the
SHELL LUBRICATION ENGINEER as
the FIRST STEP to the RIGHT SOLUTION
of any LUBRICATION PROBLEM
SHELL RUST PREVENTIVE
. . . ELIMINATES GUMMING

PROBLEM: Steel wire, drawn to proper size for use by wire rope makers, was coated at steel mill for protection during shipment and storage. Use of a rust preventive was necessary, but rope makers complained that it gummed and clogged their wire rope machines.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem he recommended a change to a Shell Ensis product. This gave complete protection, and the gumming problem disappeared. Moreover, Shell Ensis Fluid is a petroleum product . . . dissolves harmlessly when the permanent lubricant is added to rope strands.

* * *

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for a copy of Shell's 40-page booklet on Rust Prevention. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL RUST PREVENTIVES

OILS . . . FLUIDS . . . COMPOUNDS

SHELL

American Machinist's Spot NEWS OF METALWORKING

Japan will be allowed to build 20,000 to 25,000 machine tools a year, according to unofficial reports of industrial disarmament plans for that country. Over 1,000,000 machine tools are now installed in Japanese factories. Of that number 78,000 are in arsenals, 400,000 in aircraft plants and 600,000 in civilian industries. Tools in arsenals and aircraft shops, and those in plants operated mainly in making war products, are to be eliminated.

Japan's steel industry, if plans are carried out, is to be cut back to the 1926-1930 level, or 2,300,000 metric tons of ingots annually, compared with 13,000,000 tons during the war. Production of aluminum and magnesium will be prohibited, though 4000 tons of aluminum scrap can be imported for fabrication into civilian goods. Copper consumption would be limited to 70,000 tons a year, as against 150,000 tons during the war years.

An electric-powered automobile is being secretly tested by a British manufacturer. Speeds up to 50-mph. have been reached. Excessive battery weight is solved by using magnesium cell-plates.

United Automobile Workers is pressing for equalization of wages in tool and die shops no matter where located. Union points out that rates outside Detroit area, especially in the East, are 25c. to 50c. an hour less than at Detroit. They want this differential eliminated.

Civil plane manufacture is beginning to flourish. In April 1534 civil planes were built, plus 98 military planes and 50 radio-controlled target planes. Backlogs of civil makers is 27,670 units valued at $347,000,000. Only catch is that considerable duplication of orders is suspected.

Construction has begun of one of Soviet's biggest automobile plants, at Novosibirsk in western Siberia. Main shops will cover 300,000 sq. meters and will include foundry, forge shop, press shop and machine shops for making all motor and body parts. Wheels and springs will be built for other factories too. Trade schools are being set up to train skilled workers and technicians.

Fierce battle for control of guided missiles is being fought between Ordnance Department of the Army and Army Air Forces. Ordnance considers missiles as artillery, whereas Air Forces contend that they are flying machines. Latest competitive phase is Ordnance's claim for possession of high-speed wind tunnels captured in Germany.

Allison Division of General Motors is tooling up its No. 3 plant at Indianapolis to build shock absorbers. At capacity, output may be 500,000 monthly.

French will fly their first jet plane this month. Half-a-dozen German jet turbines were reconditioned for these experiments.

Easier maintenance, greatest possible rigidity and simplicity of operation are the three most desired factors in machine tools, according to production men in two user industries. Each man interviewed stressed need for minimizing the down-time of machines. This is especially true of "process" machines or multiple-operation machines which, when idle, tie up shop production.

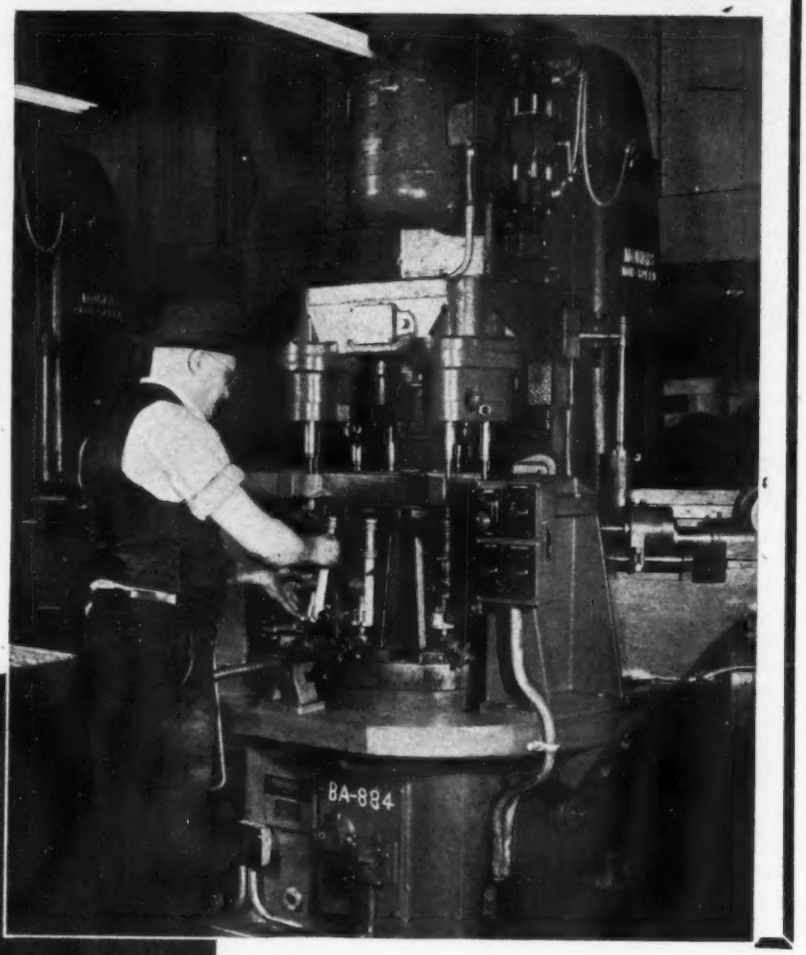
Bronze castings have been substituted for malleable iron castings by one of the largest midwest tool builders. Steel castings are being used by another company in place of gray iron and malleable.

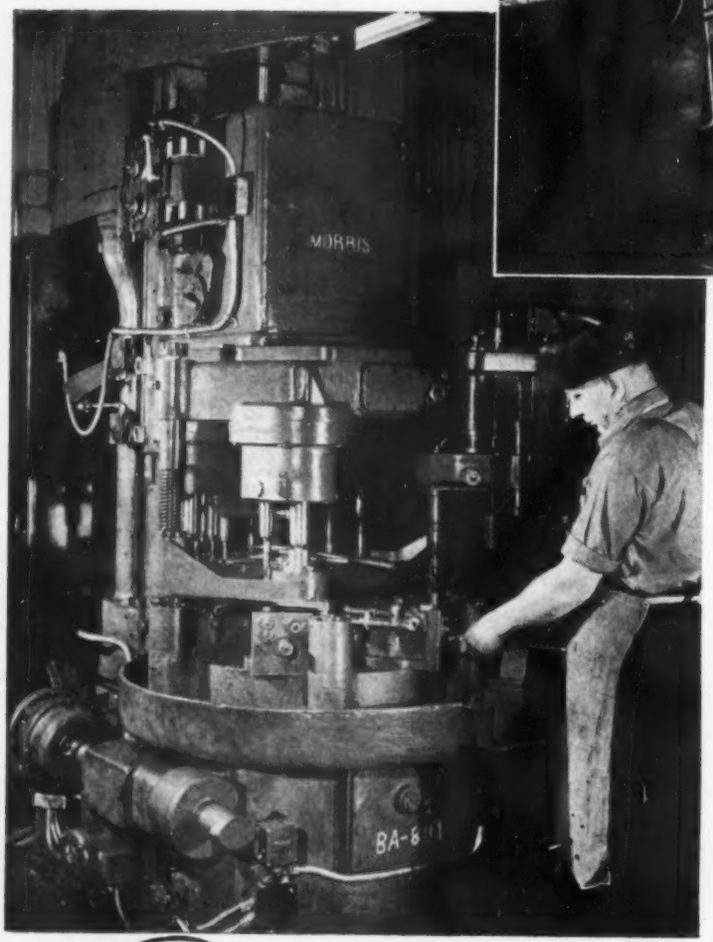
International Harvester expects to have its new factories, most of them acquired as surplus plants from the government, in full operation about the middle of 1947.

British machine tool industry has not exported any machines to Russia this year. This is in sharp contrast with heavy shipments in the first part of 1945. Exports in first four months of 1946 amount to about $8,000,000 to other nations. France has been the leading buyer.

TEAMED UP
for
MASS PRODUCTION OF PUMP BODIES

MORRIS
MOR-SPEED High Production Equipment





● Here two Morris Mor-Speed High Production Machines are set-up to handle all the "hole" operations on oil pump bodies.

On the machine at the top, drilling—reaming—boring and facing operations are accomplished on two pieces at a time in each position and cross holes drilled with cross head.

On the lower machine, drilling—reaming—counterboring—facing and tapping operations are completed. The machine is arranged for double loading to complete all required operations.

When you have work required on a mass production scale consult Morris. They have the engineering experience, the facilities and organization to develop high production units that will solve your problems and cut your costs.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.
CINCINNATI 3, OHIO

ESTABLISHED 1877

American Machinist

BURNHAM FINNEY, Editor

Mechanical Muscles

In these days of mechanical muscles, the task of handling work in process has passed largely out of human hands. Yet many improvements still can be made.

The fact is that in too many cases the capacity of machine tools is limited by the inadequate facilities for getting the work into and out of the machines. More attention often has been given to better and quicker machining than to better and quicker handling of materials and parts.

A good reason for installing new handling methods!

Transportation of parts in process is a cost element which can be high or low. And management just now, looking for ways and means of cutting costs, should be eager to reduce handling expenses.

Many factories do not know what it costs to carry materials through various departments and from machine to machine. In those which have studied the problem a startling range is revealed.

In some plants such costs are as much as 20% of manufacturing expense, in others they rise to 30%, and in still others they are as low as 10%.

With pressure on to squeeze down costs, management wants to get the most out of every machine tool. It is not just a matter of keeping machines running. They must be operated close to their full capacities if all the benefits from them are to be realized.

If proper mechanical muscles are used, the operator has no more to do than he had when output was considerably less. He does not have to quicken his pace. He works at normal speed and materials-handling devices do the rest.

Both management and men profit as a result. The former makes substantial savings in manufacturing costs, while the latter earn a higher wage because production is larger without increased fatigue.

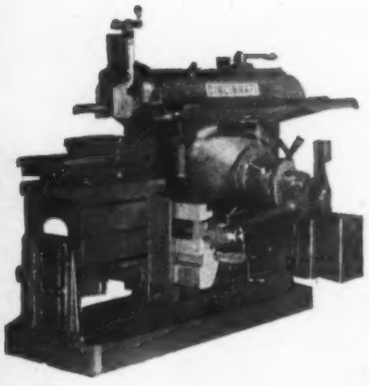
This profit combination is hard to beat. Every alert management will want to examine it carefully, especially in this era of high production costs.

Why not put mechanical muscles to work for you in your plant?

Burnham Finney

THEY LIKE IT TOUGH

Courtesy of
Federal Engineering Co.,
Detroit, Mich.



In the large tool and die shops of industry . . . day in and day out . . . standards are tough. The die steels are tough, and performance demands are tough.

Powerful, sturdy Cincinnati Shapers are found in these shops, for they are dependable on the tough job.

Write for Catalog N-3 for complete details on Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Modern MATERIALS-HANDLING METHODS

MANAGEMENT AND LABOR are uniting to make things cheaper, better and in greater quantity. The route to that goal lies in reduction of the ratio of non-productive to productive labor. Push, pull and lug in handling materials must go. In their place must come mechanization — labor-helping devices that improve production, lower costs, increase profits, raise wages, better working conditions

BY HARRY S. WHAREN
ASSOCIATE EDITOR

WHAT is materials handling? It is transportation—transportation of all materials into and through a plant, through manufacturing processes, assembly, stores and shipping. It is, however, more than transportation in the commonly accepted definition of carrying or moving materials from one place to another in a horizontal plane. It includes lifting, moving, tiering and stacking. It is the pipeline of production.

Handling costs money, which once spent adds no value and is gone forever. In almost any metalworking plant, the largest part of the so-called indirect, or non-productive, labor is engaged in moving raw materials, parts in process, scrap or finished products. In no other phase of manufacturing — cost of materials, productive labor, sales, management or fixed charges—do there exist such possible savings in production costs.

Movement of materials with maximum productive efficiency, least expenditure of money and energy, greatest safety and in the shortest possible time consistent with economy is the objective of the materials-handling system. To attain that objective, handling must be made as nearly automatic as possible by utilization of mechanical handling equipment.

As no other factor has so great an effect in reducing production costs and increasing production efficiency, the materials-handling system deserves primary consideration in the planning of the manufacturing cycle, plant layout and flow of raw materials, parts and assemblies. The ideal situation would be one in which raw materials come in one end of a plant, move through the plant in a straight line and leave as finished products at the other end, all with a minimum of back-tracking, cross hauls and number of routes. The nearer this condition can be attained, the less it will cost to handle the materials.

Well-planned systems, aimed at smoothing the flow of materials from receiving to shipping and at minimum cost, should be based on efficient handling equipment, efficient plant layout, correlation of handling with production, proper methods and operations, close cost control within the handling system and centralized supervision of all handling.

HOISTS

THE MOST COMMON hoisting device is man, inefficient though he may be and subject to many mechanical troubles not easily repaired. That is why in every modern plant a continuing effort is made to replace man with more efficient and reliable, labor-helping mechanical devices. Some of these may replace him entirely or simply aid and multiply his efforts. Of the latter, the block and tackle is the simplest, consisting of an arrangement of ropes, pulleys and pulley blocks. A mechanical advantage is obtained, as a small force moving through a long distance will lift a large load through a short distance. A similar aid is the balancer that supports drills, rivet guns and other portable tools.

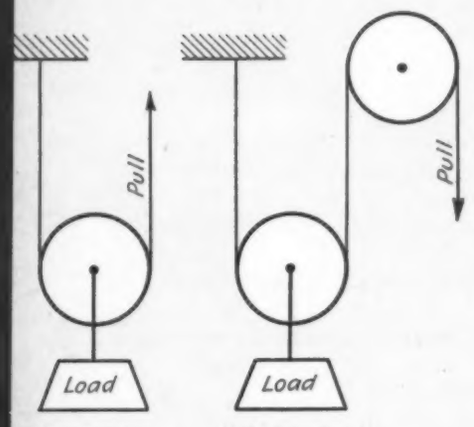
CHAIN HOISTS

Chain hoists are of four general types: differential, spur-gear, screw or worm-gear, and ratchet lever. The differential hoist is the simplest of the chain hoists and is intended for light, intermittent service. Its operation is based on the differential motion between two pulleys of different size that rotate together on a stationary block. Making the two pulleys of nearly the same size increases the mechanical advantage of the hoist.

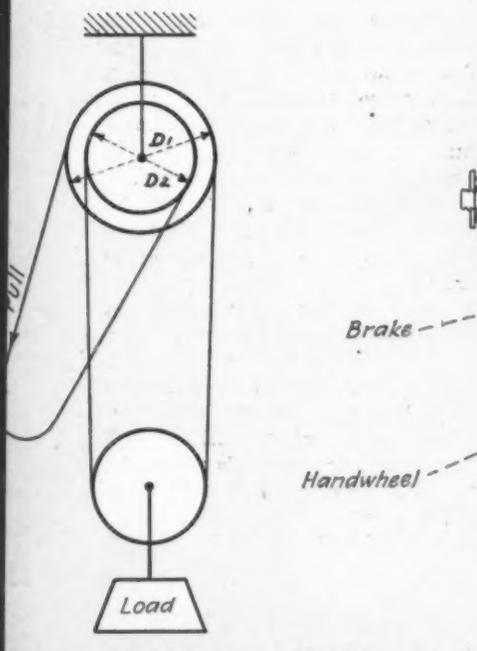
The spur-gear hoist, most efficient of chain hoists, raises the greatest weight with the least effort, is intended for general-purpose service and is recommended for maximum durability, ease of operation and speed. Power to raise the load is supplied by pulling the chain to rotate the handwheel and shaft to which it is keyed. Because of a retaining brake acting on the handwheel, a spur-gear hoist can support a load without continuous application of power.

The screw hoist, while not as efficient as the spur-gear hoist, is light, portable and well suited to light service, especially when speed is not too essential. As its operation is based on the relative motion between worm and wormwheel, it is smooth acting and can be used to advantage where positioning of the load is required or where there must not be the slightest jerking in either stopping or starting. The load, supported at any point without continuous power, can be lowered only by a reverse pull on the hand chain. The screw hoist is also useful for work on the horizontal, that is, for moving heavy loads on rollers or skids.

For work such as installation of machinery and equipment, emergency repairs and general rigging, the ratchet lever hoist is extremely useful in both the horizontal and vertical positions. Easy lift is achieved by the design of the lifting mechanism which consists of a ratchet and pawl on small models and a gear reduction unit on those of greater capacity. As the handwheel is interlocked with the load brake, the brake can be released and the chain freed so that the handwheel can be operated either by hand or directly on the chain without use of the ratchet lever.

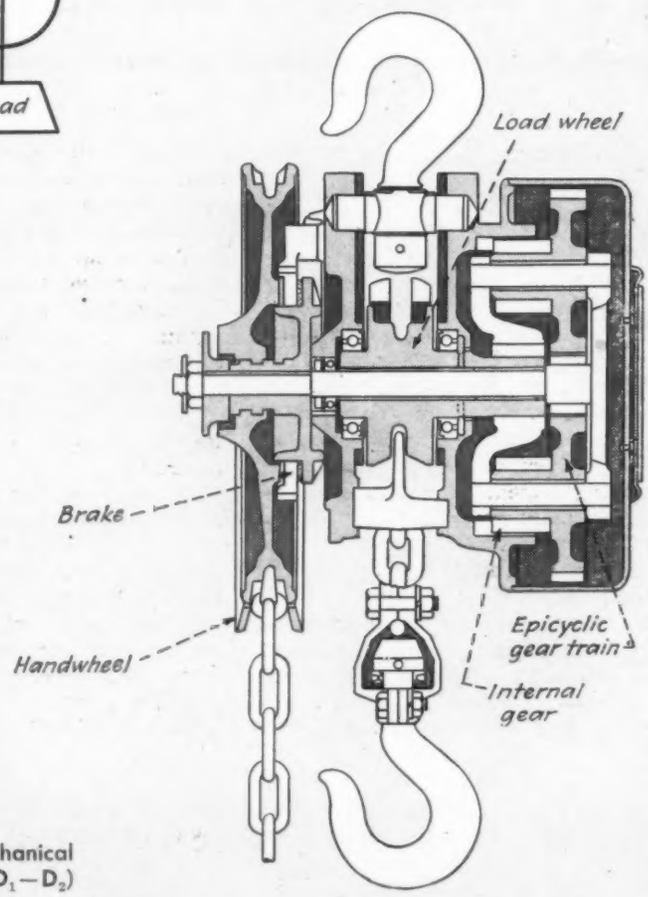


Block and tackle where number of supporting ropes equals mechanical advantage. Fixed pulley changes direction of pull only



Differential hoist where mechanical advantage equals $2D_1 \div (D_1 - D_2)$

Spur-gear hoist gains mechanical advantage through epicyclic gear train connecting handwheel shaft and load wheel



AIR HOISTS

Air, or pneumatic, hoists are of two types: cylinder and air motor. Both types operate by compressed air, are economical to install and use, and provide smooth, accurate control of the load. Their smooth operation makes them especially suitable for applications such as handling molds in foundries and molten metal in mills, feeding furnaces, setting automobile bodies in position on assembly lines and setting up work for machine operations.

Cylinder hoists may be either single or double acting. A single-acting

hoist is operated by admission and exhaust of air on the stuffingbox side only. Thus, there is a variable pressure on the stuffingbox side and atmospheric pressure on the opposite side of the piston. A more accurately controlled hoist is obtained by means of an air balance as provided in the double-acting type.

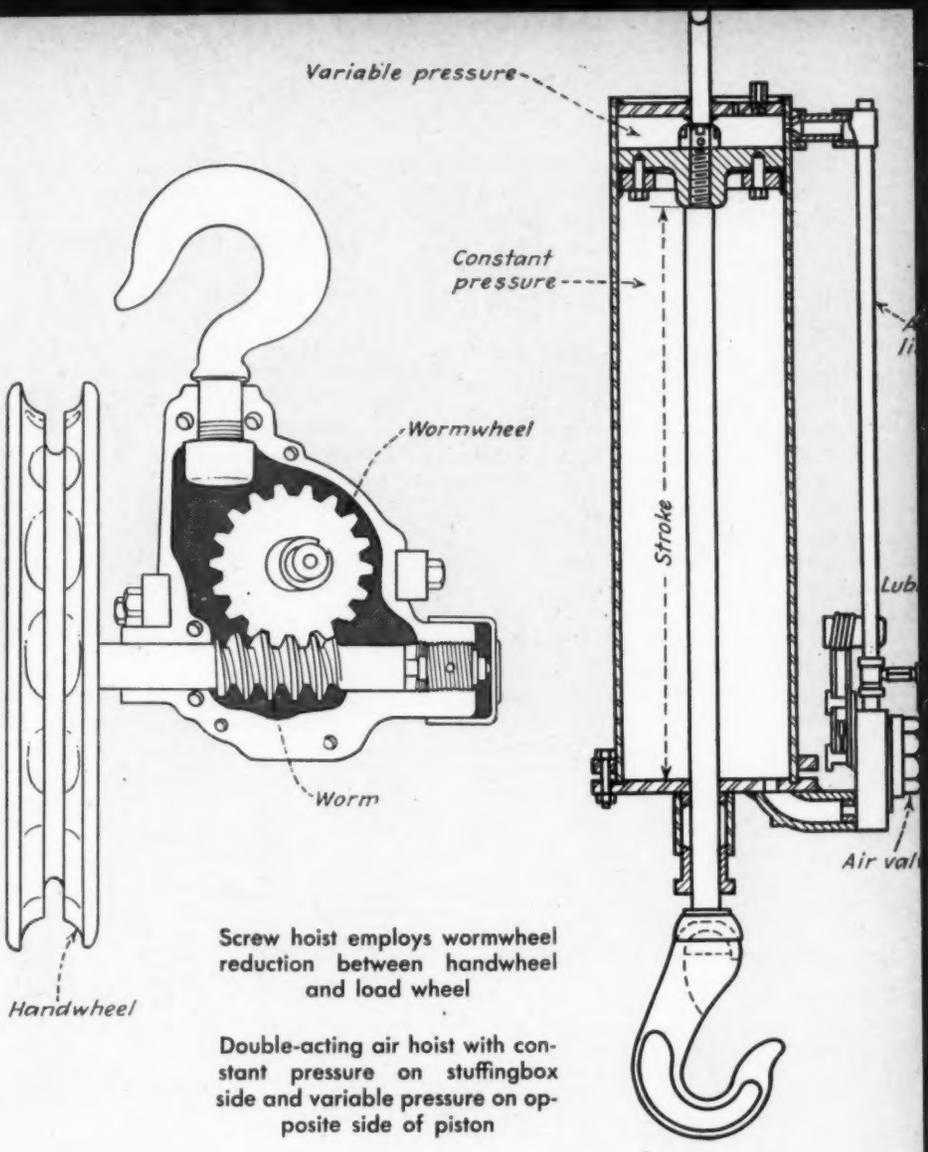
A full constant pressure is maintained on the stuffingbox side, and a variable pressure on the opposite side. Admitting air into the top of the cylinder, that is, into the side of variable pressure, lowers the load because of the unbalanced area of the rod. Exhausting the air above the piston raises the load. This hoist has excellent speed control and is suited to the most delicate hoisting. When both full-power push and pull on the rod is required, a double-acting hoist with variable pressure on both sides of the piston must be used, air being admitted into and exhausted from both ends of the cylinder.

Air-motor hoists, ranging in capacity from ¼ to 10 tons, require a greater initial investment than cylinder hoists, but are as economical to operate and maintain. The motor is of the reciprocating-piston type and is totally enclosed and free from the effect of heat and dust. An automatic brake holds the load at any position, even when the air supply is shut off. If the hoist is supported on a trolley, the air line can be disconnected and the hoist moved to a new position without releasing the load. Air lines on a movable unit, however, are generally cumbersome and unhandy to install and use. The air motor usually operates at a pressure of 80 psi., but will operate at a lower or higher pressure at a correspondingly slower or faster speed.

ELECTRIC HOISTS

Electric hoists, ranging in capacity from ⅛ to 20 tons, have a far wider application than chain or air hoists when high speeds are required for economic operation. Being used in every field of metalworking, they are accordingly designed to meet varying needs in operation and are furnished with one or two motors, single- or multiple-speed control, and push-button, pendant-rope, outrig or remote operating features.

Hoists are available for use with either direct or alternating current. The dc. motors are series wound, whereas the ac. motors are high-torque, polyphase, induction type with either wound-rotor or squirrel-cage



Screw hoist employs wormwheel reduction between handwheel and load wheel

Double-acting air hoist with constant pressure on stuffingbox side and variable pressure on opposite side of piston

OPERATING DATA FOR CHAIN HOISTS

RATED CAPACITY TONS	PULL (LB.) ON HAND CHAIN TO RAISE FULL LOAD			HAND CHAIN OVERHAUL (FT.) TO RAISE LOAD 1 FT.			SPEED (FPM.) AND NUMBER OF MEN NEEDED TO LIFT CAPACITY LOADS WITHOUT PULLING OVER 78 LB. EXCEPT ON 1-TON SCREW HOIST					
	SPUR GEAR	SCREW	DIFFERENTIAL	SPUR GEAR	SCREW	DIFFERENTIAL	SPUR GEAR	NO. MEN	SCREW	NO. MEN	DIFFERENTIAL	NO. MEN
*300	52			6.6			31.3	1				
*700	76			10.4			13.9	1				
*1000	65			17.5			9.5	1				
¼	48		72	11.86		18	19.3	1			8.5	1
½	56	66	112	20.5	38.5	24	9.65	1	4.34	1	8.2	2
1	72	85	189	31.4	58.66	30	4.86	1	2.2	1	3.88	3
1½	99	93	224	35.	78.66	36	6.35	2	3.	2	4.1	3
2	104	112	301	43.1	95.4	42	4.87	2	2.06	2	3.48	4
3**	97			77.93			2.96	2				
3	102	110		70.	153.25		3.00	2	1.3	2		
4	108	140		86.2	160.5		2.37	2	0.98	2		
5**	83	140		153.2	203.		1.73	2	0.775	2		
5	92			129.3			1.85	2				
6**	99	145		153.2	256.		1.45	2	0.59	2		
6	110			129.3			1.55	2				
8	112	164		172.4	306.		1.14	2	0.44	2		
10	115	148		215.5	382.		.89	2	0.39	2		
12***	110			129.3			1.55	4				
16	112			172.4			1.14	4				
20	115			215.5			.89	4				
25	125			258.6			.68	4				
30	107			383.0			.54	4				
40	122			459.6			.39	4				

*Quick lift hoist, capacity noted in pounds. **Single chain 3-ton hoist, 5- and 6-ton double chain hoists. ***For each hand chain. 12-ton hoists and larger have 2 hand chains each, permitting 2 men to hoist simultaneously.

winding. Power from the motor is transmitted to the grooved winding drum through reduction gears. The grooved drum carries a single layer of steel wire rope or cable which is dead-ended to the frame of the hoist.

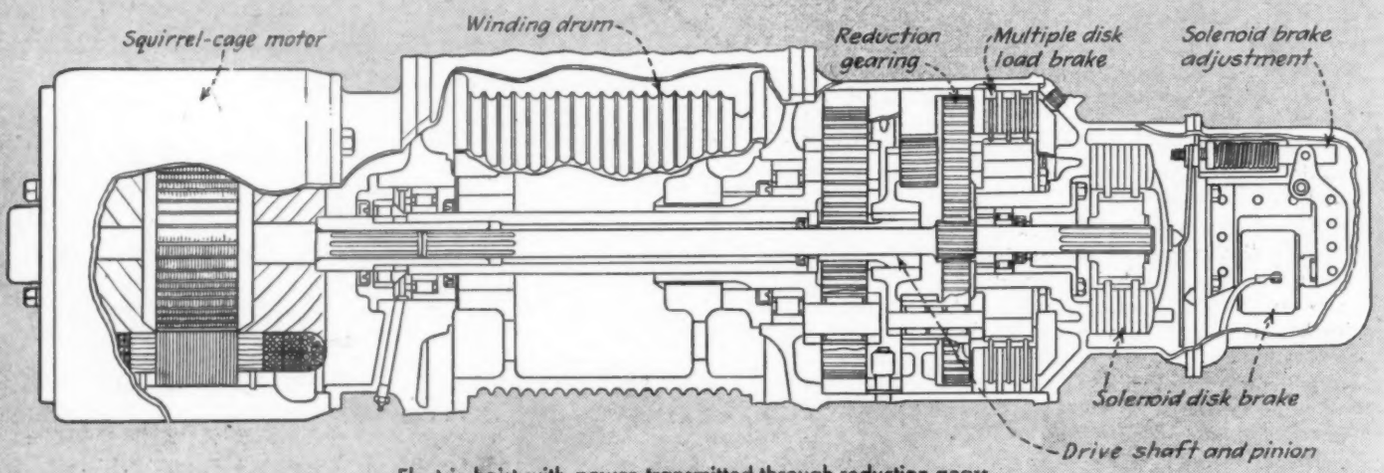
Two brakes, mechanical and electrical, should be provided on electric hoists. A mechanical brake, of the multiple-disk or worm gear type, holds the load when the motor is at rest and prevents excessive speed in lowering the load. A multiple-disk brake can be adjusted to set whenever the load tends to descend at a speed slightly greater than that corresponding to the speed of the motor. The electric brake, also of the multiple-disk type, is operated by a solenoid. When the current is interrupted, the brake sets unless held off by a current flowing through its windings. Either brake has sufficient capacity to support a full load.

HOIST OPERATION

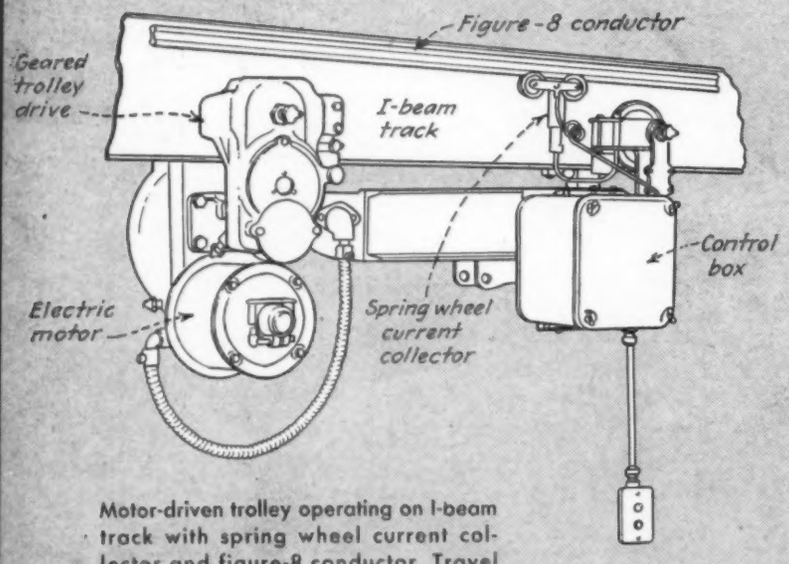
Chain, air and electric hoists may be operated as simple lifting and lowering devices or mounted in a number of ways to extend their usefulness. They may be supported on jib cranes, on monorail cranes by means of plain, geared or motor-driven trolleys, and on overhead traveling cranes. When the hoist is supported on a plain trolley, it is moved with its load by a push or pull on the load or hoist hook. With a geared trolley, the operator moves the hoist along the runway by pulling the hand chain.

For fast travel and maximum efficiency, motor-driven trolleys are recommended. Current for trolleys and electric hoists is transmitted through an arrangement of conductors and collectors. Conductors, supported by insulators on cross-bars mounted on the track, may be of the wire, bar, figure-8, angle or T types.

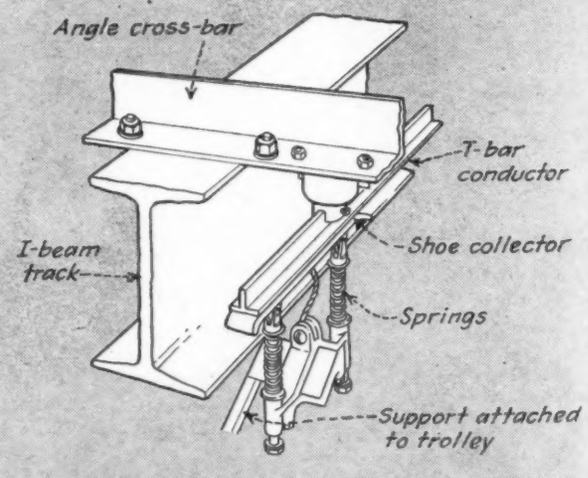
The current collectors may be made in the form of rigid or spring shoes or spring wheels. Rigid-shoe collectors are used with stretched wire conductors without intermediate supports, spring shoes with angle or T-bar conductors, and spring wheels with wire or figure-8 conductors supported by insulators spaced along the track. Intermediate supports are not needed on straight runways up to 40 ft. in length, but for longer spans supports are spaced 6 to 8 ft. apart. Spacing on curved runways depends on the radius of curves, usually being about 3 ft.



Electric hoist with power transmitted through reduction gears and arranged with mechanical and electrical disk brakes



Motor-driven trolley operating on I-beam track with spring wheel current collector and figure-8 conductor. Travel speeds range from 100 to 500 fpm.



Spring shoe current collector contacting T-bar conductor supported from I-beam track by angle cross-bar

CRANES

APPLIED to the lifting and transporting of loads, both light and heavy, cranes offer a flexible means of handling materials within their range, which varies according to type and size of crane. Thus, an overhead traveling bridge crane can serve the width and length of the area encompassed by its runways whereas a tractor crane is relatively unlimited in its area of service. Shop cranes operate without interference with work on the floor and neither require floor space nor are affected by cross traffic or non-uniformity of loads or rates. Of the many types, those particularly used in metalworking shops are the hand or powered portable cranes, jib and pillar cranes, derricks, and gantry, traveling bridge and monorail cranes.

PORTABLE CRANES

Hand-operated portable floor cranes are the simplest of portable cranes and are especially useful in shops for setting up work in machines, handling dies and similar operations. The usual type consists essentially of a curved boom mounted on a low platform that is carried on wheels widely spaced to insure stability. The boom curves over the platform so that the weight of the load, being centered, will not tip the crane. The lifting mechanism may be either a standard hand winch and tackle or a chain hoist.

On the former, the winch is mounted on the vertical part of the boom and a steel wire rope runs over a series of pulleys to the block supported from the end of the boom. As either one pair of wheels is pivoted or all the wheels have swivel casters, a crane with its load can be moved easily. Such cranes are made in capacities up to 3 tons or more and in heights up to 12 ft.

Power Portable Cranes

Powered portable industrial-type cranes are more widely used than hand-operated cranes and are available in capacities up to 10 tons. Of the various types in use, the first developed had a load-carrying platform, whereas the tractor crane, which is now more popular, is made without a load-carrying platform.

Provided with a power-operated rotating, luffing and telescoping boom, a tractor crane is extremely useful for many operations in a shop and may have its capacity increased by addition of an outrigger. The hook and boom have separate hoists controlled by solenoid brakes and electric limit switches that stop travel at extreme upper limits. Maximum speeds are approximately 5 mph. with no load and 4½ mph. with full load. Tractor cranes are generally electric or gas-electric powered.

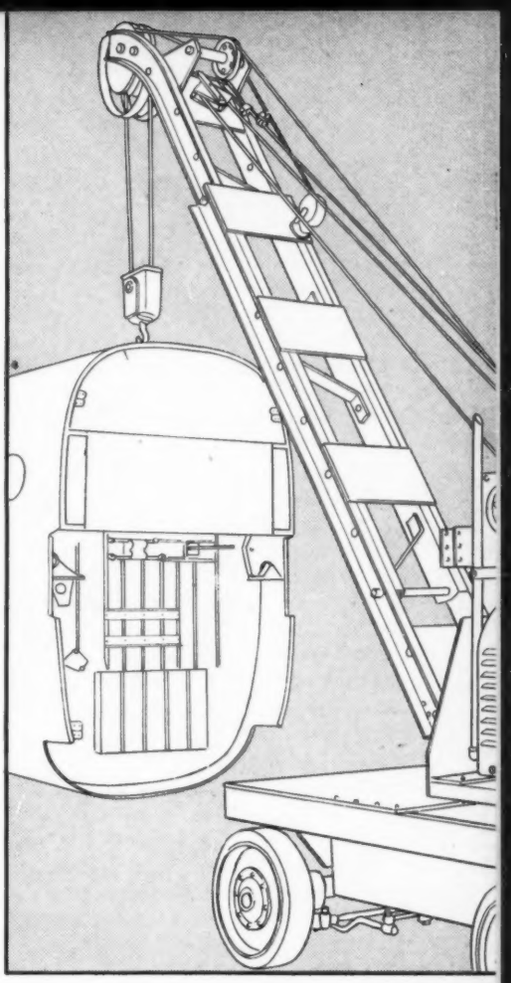
As tractor cranes are generally equipped with solid rubber tires, they are most useful indoors or on paved surfaces outdoors. For movement over streets, unpaved yards and fields, truck cranes fitted with large pneumatic tires are better suited, their particular advantage being the flexibility provided by the pneumatic tires.

For service on very soft or rough ground, a special type of truck crane, known as a crawler crane, is most effective because the weight of the crane is spread over a large surface. The boom of a crawler crane can usually swing through at full circle and varies in length according to the work to be done. Truck and crawler cranes are powered by diesel or gasoline engines and range in capacity from 2½ to 50 tons.

Locomotive Cranes

Locomotive cranes, so called as they are self-propelled on tracks, are rotary traveling cranes consisting of a hinged boom and power plant installed on a turntable carried on a car body. They are powered by steam, gasoline or electricity, depending on the service required and the location in which the crane is to be operated.

At present truck and crawler cranes have largely supplanted locomotive cranes for general duty around shops, but where there is already a network of standard or narrow gage railroad tracks locomotive cranes are valuable. They range in capacity up to 200 tons with booms to 170 ft. To adapt them to a wide variety of operations, locomotive, truck and crawler cranes can be equipped with blocks for general hoisting, grab or dragline buckets for handling loose material, and electro-magnets for handling iron and steel.



Tractor cranes are adapted to a wide variety of handling operations, both in storing and assembly

JIB AND PILLAR

Overhead cranes, as compared to portable cranes, serve a specific area only as they are not portable from job to job. Each type has its particular application and may supplement another type of crane or any other kind of materials-handling equipment.

Jib cranes, simplest of the overhead cranes, consist primarily of a jib, usually a straight bar or an I-beam, fixed or pivoted to a vertical mast and guyed from its outer end to the mast. The load, supported from a trolley or at the end of the jib, is raised or lowered by hoist or winch. The mast is generally pivoted at the top and bottom to allow swinging, but it may be mounted on wheels to provide motion along a track or runway.

A jib crane pivoted at the top and bottom is known as a rotary jib

crane. The simplest type is the wall-bracket jib crane the mast of which is pivoted in brackets secured to a wall or post. The end of the jib is supported by a tie rod extending to the top of the mast. To reduce the stress in the tie rod, its hinge plate is placed as high as possible. If no trolley is used and the load is carried at the end of the jib only, the crane is called a swing crane.

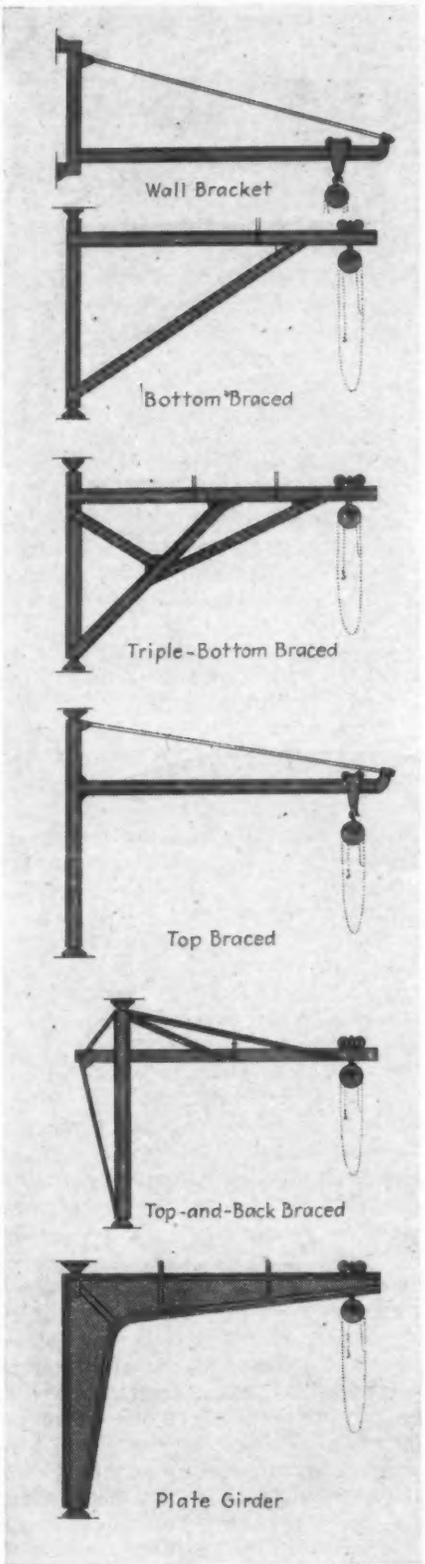
Column jib cranes are those on which the horizontal jib is attached to a rotating column, or mast, pivoted in top and bottom bearings in the ceiling and floor. These cranes, designated according to the method of bracing, are bottom braced, triple-bottom braced, top braced or top-and-back braced. A bottom-braced crane has its jib secured near the top of the column and supported by braces. The simplest type of bottom-braced crane has a single diagonal strut running from the bottom of the column to a point near the end of the jib. If the strut is run to the middle of the jib and short diagonal struts are run from its middle point to the ends of the jib, the crane is known as a triple-bottom-braced crane.

Bottom bracing may be used where the jib length is moderate, where the space around the mast is not especially needed, and where the headroom is limited. Triple-bottom bracing is adapted to heavier construction and long jibs, is more economical of space around the mast and is also useful for lifts with little headroom.

Top Bracing

The top-braced column jib crane has its jib secured to the column at a point some distance below the top and supported by a diagonal tie. Top bracing leaves the space underneath clear for the full length of the jib, allows the load to be handled with equal facility either at the end of the jib or close to the column, but requires much more headroom than does bottom bracing.

The top-and-back-braced crane is similar in construction to the top-braced crane, except that the jib extends some distance back of the column and is supported by a tie and a strut running to the top and bottom of the column respectively. The front part of the jib is also supported by ties running to the top of the column. This construction, used largely in outdoor service or indoors where headroom is ample, provides maximum clearance under the jib and is adapted to all capacities and long jibs.



Jib cranes including wall bracket, bottom-braced, triple-bottom braced, top-braced, top-and-back braced and plate-girder jibs

Another rotary jib crane, built in the form of a curved plate girder, provides clearance under jib, requires little headroom and needs no external bracing as its construction makes it inherently rigid and strong.

A special type of rotatry jib crane has a swinging jib supported near its outer end by a curved trolley track. The pivot plate of the jib can be attached to a column or wall, or suspended from the ceiling. The trolley track, which varies in size and radius according to the desired working area, provides a good support and makes the crane especially useful for moving heavy loads from one machine to another.

Rotary jib cranes have their greatest value in handling materials at machine tools, steam hammers and other machines. By supplementing the traveling bridge crane, particularly for frequent and short handling operations, jib cranes are extremely effective in relieving congestion and increasing production with only a relatively small investment required.

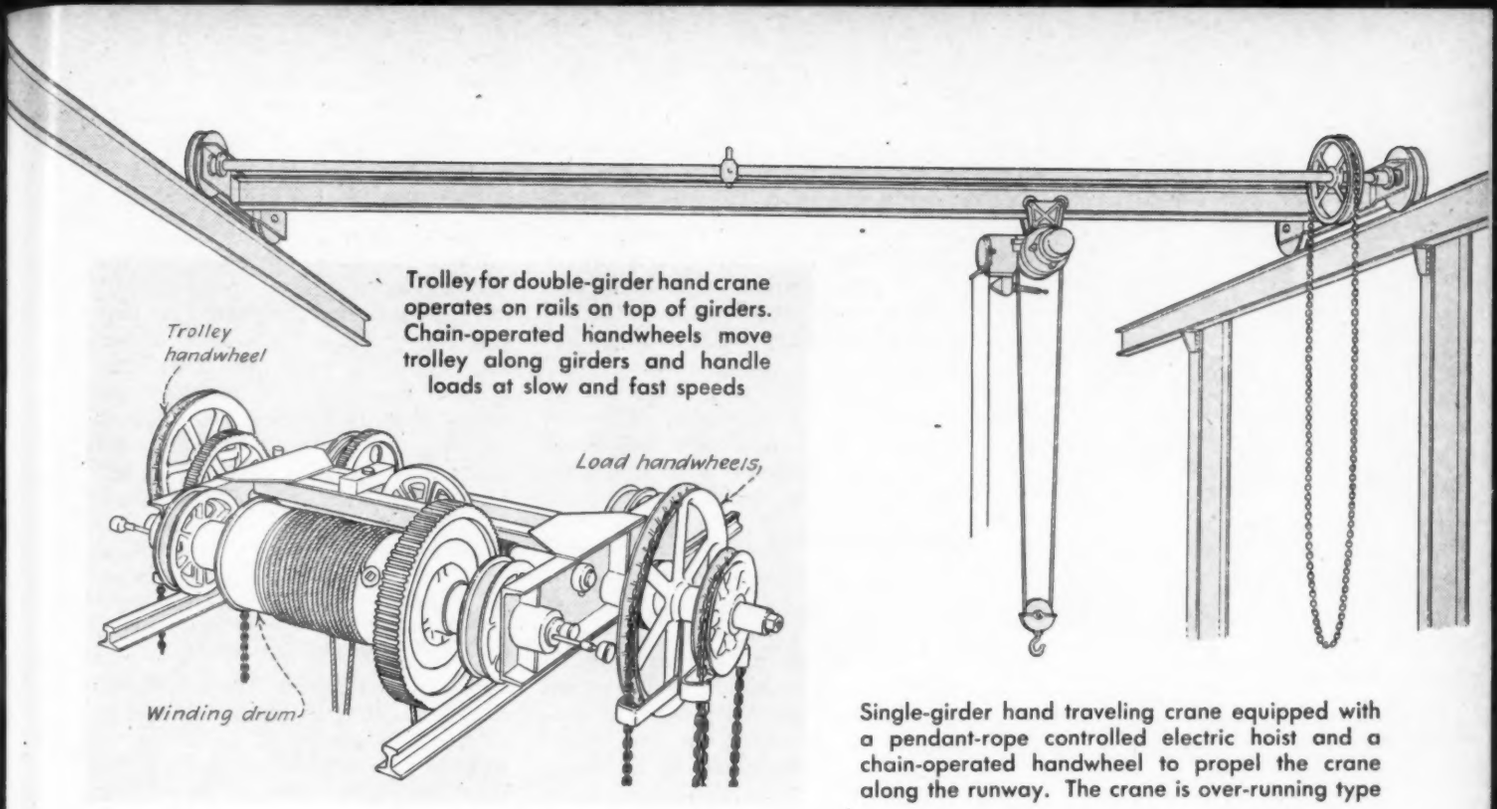
Special Cranes

Unusual conditions often require the use of jib cranes of special design. Among these are portable jibs that can be moved from one building column to another, wall-traveling jibs, walking jibs that serve an extended area, and motor-operated jibs for handling spouts of open-hearth furnaces.

The wall-traveling jib crane travels on a rail runway attached to one side of a building. The jib is supported by a wall frame provided with a top and bottom set of wheels traveling on parallel runways. A crane trolley is mounted on the jib which has no swinging motion. Usually the crane is electrically operated with three independent motors controlled from a cab hung from the structure of the crane. Supplied in capacities up to 10 tons and with jibs up to 30 ft., wall-traveling jib cranes generally act as auxiliaries to traveling bridge cranes.

The walking jib crane runs on a single line of rails on the floor and is supported at the top by guide rollers on the upper end of the mast running in a parallel overhead track. It is entirely motor operated and provides a flexible means for handling work in railroad repair and other shops.

A crane with a self-supported rotating pillar, or mast, that supports an inclined boom is known as a pillar crane. Its principal application is in railroad and shop yards for loading



Trolley for double-girder hand crane operates on rails on top of girders. Chain-operated handwheels move trolley along girders and handle loads at slow and fast speeds

Single-girder hand traveling crane equipped with a pendant-rope controlled electric hoist and a chain-operated handwheel to propel the crane along the runway. The crane is over-running type

and unloading of materials and for general lifting purposes. Being self-supporting on its base, it is suitable for outdoor as well as indoor service and can be mounted on flat cars or moved from one location to another.

The pillar, either a tapered steel casting or built up of steel plates, is held in an upright position on its base by a tension rod. The boom extending from the bottom of the pillar is held rigidly by tie rods from the top of the pillar to the end of the boom. Pillar cranes are either hand operated by a hoisting winch installed on the boom or power operated by an electric motor mounted on a platform that turns with the pillar.

If the inclined boom is replaced by a horizontal jib with a traveling trolley, the crane is called a pillar-jib crane. This type of crane is intended for use in locations where the top of the mast cannot be supported in a bearing but where the clearance of a jib crane is needed and a whole circular area around the crane must be served to carry on production.

DERRICKS

Derricks, supplied in capacities up to 50 tons, have a limited application in metalworking plants, being used principally for loading and unloading materials and for general heavy lifting. A derrick is actually a rotary crane having a vertical mast and means of holding it in position, a boom, operating ropes and a hoisting winch. The two main types are the stiff-leg and guy derricks.

The stiff-leg derrick has its boom stepped on a universal joint to permit its movement in any direction. The end of the boom is connected to the top of the mast by a block and tackle that controls its angle of inclination. Another block and tackle is suspended from the end of the boom, with the free pulley carrying the load. The rope is passed through pulleys to the driving mechanism which may be a hand-operated crab or a steam, gasoline, diesel or electric winch.

The guy derrick differs from the stiff-leg derrick in having its vertical mast supported by guy lines rather than a solid leg. The guy lines should be anchored at a distance from the base of the mast equal to at least one and a half times the height of the mast in order to clear the boom. Either type of derrick may be provided with a bull wheel at the bottom of the mast for rotating the mast, boom and load.

GANTRY CRANES

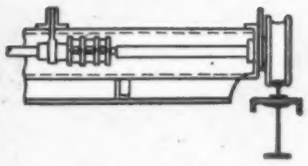
Gantry cranes, as derricks, have their principal uses in metalworking plants in loading, unloading, and storing materials, in transferring heavy freight and in erecting work in shipyards. They are adapted to situations where overhead runways would interfere with handling operations or with storage space. Also, when necessary, the location of a gantry crane may be changed by laying additional track. Gantries are particularly useful where the crane itself does little traveling but the transfer of materials is sideways and may be handled almost entirely by the trolley mounted and traveling lengthwise on the gantry bridge.

Gantry cranes of either the fixed or traveling types are usually built in sizes from 1 to 150 tons, although larger gantries, up to 350 tons, are in use. Small portable gantry cranes are particularly adapted to setting up work in machine tools as they can span the machine. Such gantries have a chain hoist attached to the bridge and are equipped with swivel casters.

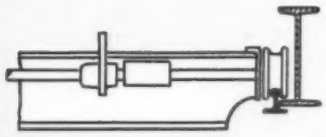
On the large gantries the bridge is carried at a considerable distance above the ground on A-shaped end frames, and a trolley, carrying the hoist, operates on runways on the bridge. If both end frames, or legs, are the same height, the crane is a full portal gantry, but if one end is supported on an elevated runway, the crane is a semi-portal gantry. When the bridge overhangs one or both legs, the gantry is semi- or double-cantilever. Instead of a trolley, a gantry crane may have mounted on its bridge a stiff-leg derrick or a rotating pillar or jib crane.

BRIDGE CRANES

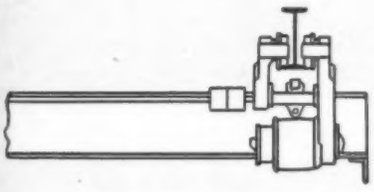
Overhead traveling bridge cranes have a wider application in industrial plants than any other type of crane because of their adaptability to manufacturing processes and their handling of loads in any direction over an entire area without interference with work in progress on the floor and without sacrifice of floor space. They may be operated by either hand or electrical power. Hand-oper-



Over-Running

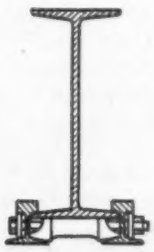


Inner-Running



Under-Running

Trolley arrangements for over-running, inner-running and under-running cranes. Available head-room dictates selection of crane



Auxiliary track mounted on lower flange of I-beam runway to take wear from softer and more ductile runway

ated traveling cranes are particularly applicable to light or infrequent service in machine shops, foundries, engine rooms and other places where speed of operation is not required. Electric traveling cranes, however, are needed for heavy loads and fast operation.

When a crane must have a long span to cover a large area, an electric crane is more adaptable and much more easily managed than is a hand crane.

Hand-Operated Traveling Cranes

The simplest type of traveling crane is entirely hand operated and consists of a single steel beam supported at its ends on wheels running on elevated runways. A trolley from which the hoist and load are suspended is mounted on the single beam, or bridge, and is a simple traveler moved by pulling or pushing on the load. The crane is moved along its tracks in the same manner. The hoisting apparatus is usually a chain hoist or a block as these cranes are intended for only light service, but may be an electric hoist for faster service.

Hand-operated cranes of greater capacity have geared to one wheel on each end truck a squaring shaft that assures uniform travel of both sides of the crane. Keyed to the squaring shaft is a handwheel that is operated by an endless hand chain to propel the crane along the runway. The span of such single-girder cranes is generally limited to 30 ft., and the capacity to 10 tons.

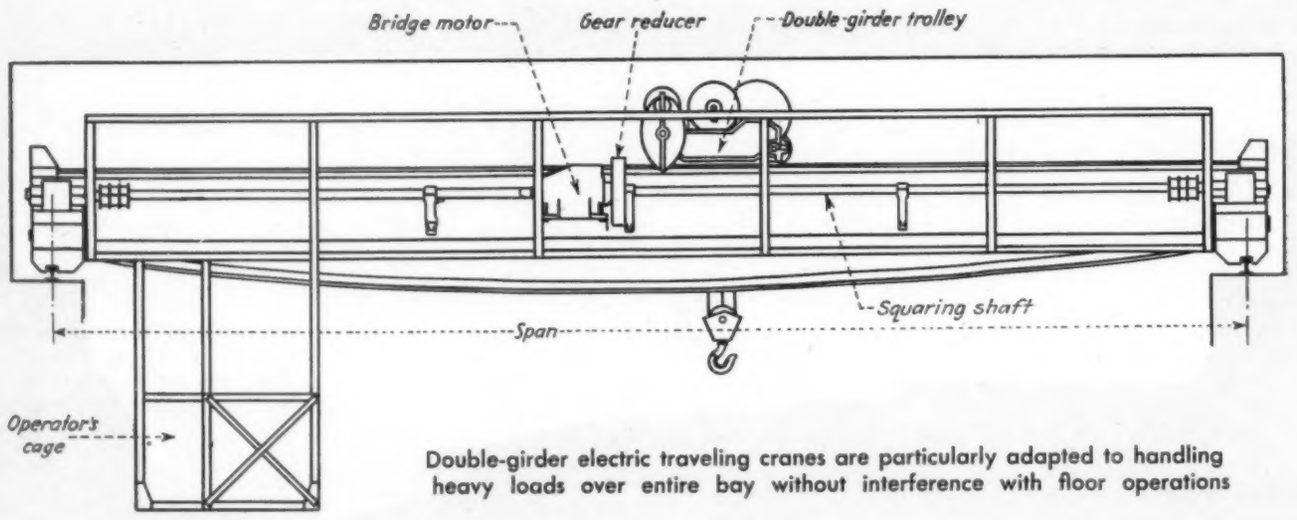
Greater spans and capacities in hand-operated cranes, up to 60 ft. and 50 tons, require a double-girder bridge. Such cranes are installed where heavy loads must be handled but not often enough to justify the expense of an electric traveling crane.

These too are operated on the runway by a spur-gear drive, but have a spur-gear driven trolley that rides on both girders and is of the steel cable and drum type. The drum is grooved to receive the cable which leads to a fall block supporting the load hook. An automatic brake holds and controls the load at all times. Movement of the load is accomplished by hand chains—one for handling heavy loads at slow speeds and another for handling light loads or the empty hook at fast speeds.

Electric Traveling Cranes

Where considerable work is to be done and electric current is available, it is advisable to install a crane with complete electrical operation for service heavier than about 10 tons. Electric traveling cranes, as hand-operated cranes, are made with both single- and double-girder bridges. The single-girder type may be over-running where the bridge operates on top of the runway; inner-running where the bridge operates on the inside of the runway; or under-running where the bridge operates on the bottom of the runway. The latter type is adapted to operate in locations where it is desirable to hang the runways from roof trusses in order to eliminate the expense of supporting columns or where limited headroom does not permit the use of an over-running crane.

Auxiliary track in the form of high-carbon high-manganese steel T-rail may be mounted on the lower flange of the I-beam runway for inner-running and under-running



Double-girder electric traveling cranes are particularly adapted to handling heavy loads over entire bay without interference with floor operations

cranes. As all wear is concentrated on the T-rail, the softer and more ductile runway is protected from deterioration. The T-rail is mounted, either in one or both sides of the lower flange of the I-beam, by bolt clamps having inside spacers to hold the rail in position. This mounting provides a continuous support for the rail, yet requires no holes in the load-carrying I-beam and no bolts under any appreciable stress from the loads carried.

Crane Bridges

Bridges for electric traveling cranes are generally built of welded or riveted box girders, each consisting of web-plate sides connected with channel or I-beam diaphragms and tied together at their ends by end trucks that operate on the runways. Trolley rails, fastened to the top of the girders by steel clips and bolts, are provided with large stops to prevent overtravel of the trolley.

The bridge of the crane is driven along the runways by an electric motor placed at the center of the span and mounted in either a horizontal or vertical position, according to make and size of the crane. The motor is connected to a gear-reducer through which is passed the squaring shaft that leads to and drives a wheel on each end truck. Travel of the bridge, when the cage is attached to the crane bridge, is controlled by a shoe or disk type of hydraulic or mechanical brake operated by a foot lever in the operator's cage. When the cage is attached to the trolley or when the crane is arranged for control from the floor, an electric solenoid brake must be used.

Crane trolleys are built up of welded or riveted members to form the frame that supports the drums, motors, brakes and gearing mechanisms. For cranes up to 15-ton capacity, the end frames may be of archbar design, whereas larger trolleys require end frames of the solid girder type.

Hoisting Mechanism

The hoisting drum, driven by an electric motor through flexible couplings and a gear-reducer, has both right-hand and left-hand grooves to receive the full length of the rope supporting the sheave block without overlapping. A large diameter of drum increases the life of the rope; with a diameter at least twenty-four times the diameter of the rope, the bending stresses in the rope are kept low and the fatigue action is reduced considerably.

Control of the load, when lowering, is provided by a mechanical brake of the friction type with an ac. drive or by dynamic braking with dc. drive. In addition, a solenoid brake of the brake shoe type connected to the hoisting motor holds the load at any position when the power is off. Dynamic braking requires a resistor and drum or magnetic controller. The drum contactors, in the case of magnetic control, are arranged to reproportion the same resistor in the series field and armature circuits of the series hoist motor in such a way that the series motor is converted to a shunt motor or generator. For light loads it functions as a shunt motor, and for heavy loads as a generator. Breaking of the current causes the motor to act as a series generator, creating sufficient counter torque to retard the load for safe lowering.

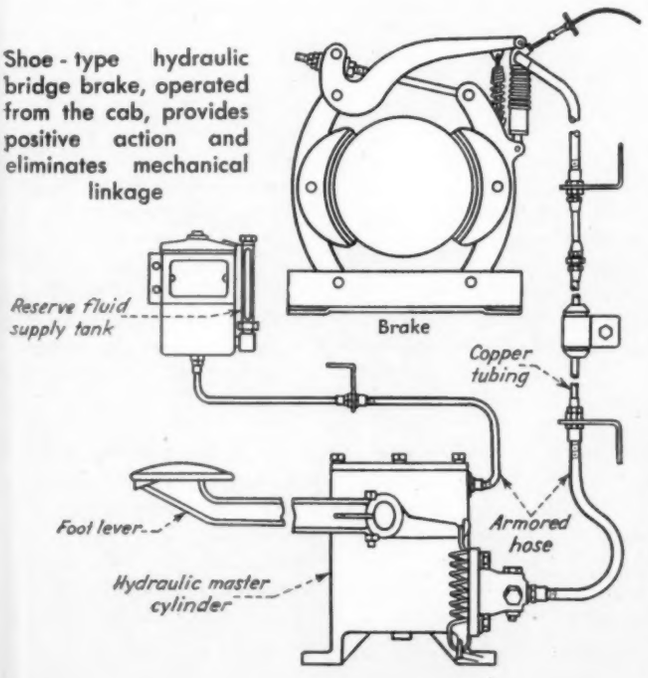
Travel of the trolley along the bridge is effected by a second electric motor mounted on the trolley and acting through a speed-reducer. The slow-speed gear shaft of the reducer is connected by flexible couplings to a cross-shaft leading to the driving wheels of the trolley. For special applications where slower trolley speeds are required, as in power-house service, the speed-reducer can be made with three steps of reduction or an extra gear and pinion can be located at the driving wheels.

Some cranes have two or more hooks, even twin trolleys to handle special loads. Multiple hooks give high-speed action for light loads, while heavier loads are handled more slowly.

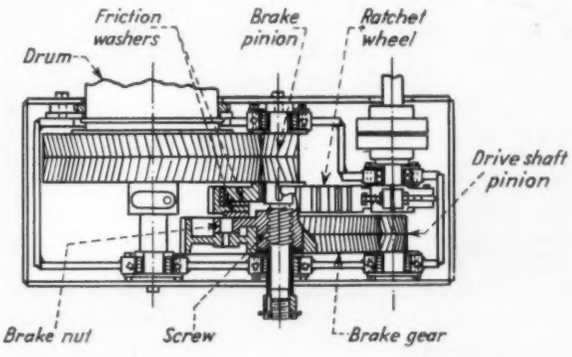
Standard Blocks

Standard crane blocks contain from two to twelve operating sheaves, depending on the capacity of the crane and size of the rope. For example, a 60-ton crane may use 8 parts of 1⅛-in. rope or 10 parts of 1-in. rope. A greater number of rope parts permits the use of a smaller rope and a smaller diameter of drum, thereby allowing a reduction in the over-all depth of the crane. If headroom is critical, such a reduction may be needed to give sufficient lift.

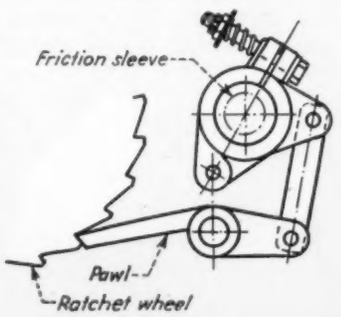
To control the upper limit of travel of the block and prevent damage to both trolley and block, each trolley is equipped with a limit switch of the lever or weight type. The switch is actuated by the block rising against its lever or weight, thereby breaking the current of the hoisting motor and preventing further upward travel. The switch automatically resets when the operator lowers the load.

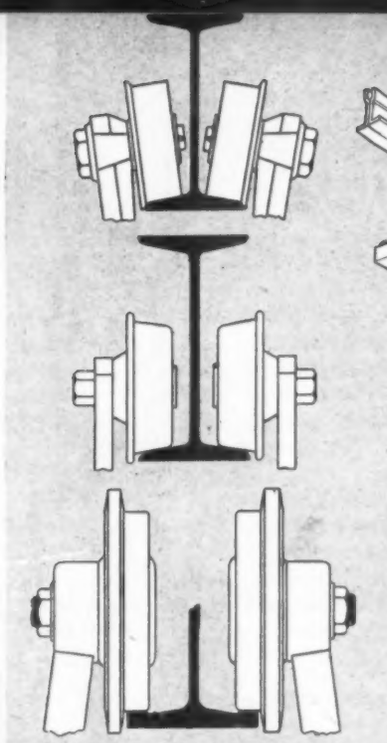


Shoe-type hydraulic bridge brake, operated from the cab, provides positive action and eliminates mechanical linkage

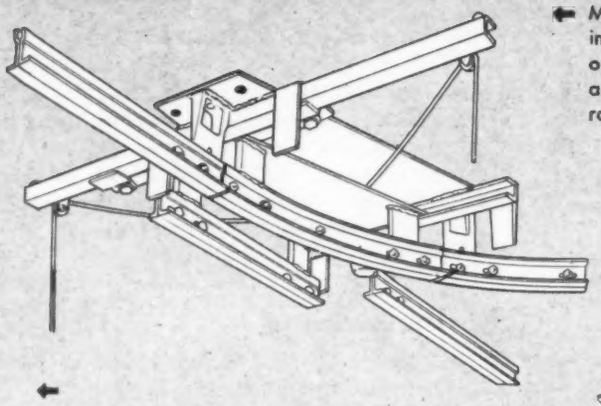


Ratchet wheel and brake gear revolve together until reversing the motor actuates pawl and stops the wheel. Too rapid lowering advances the brake nut on the screw and automatically engages the brake friction washers



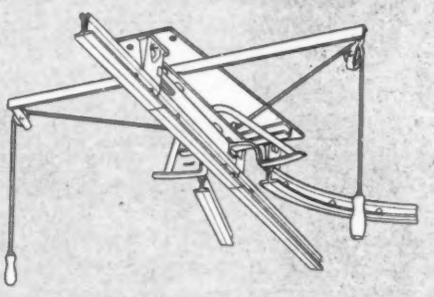


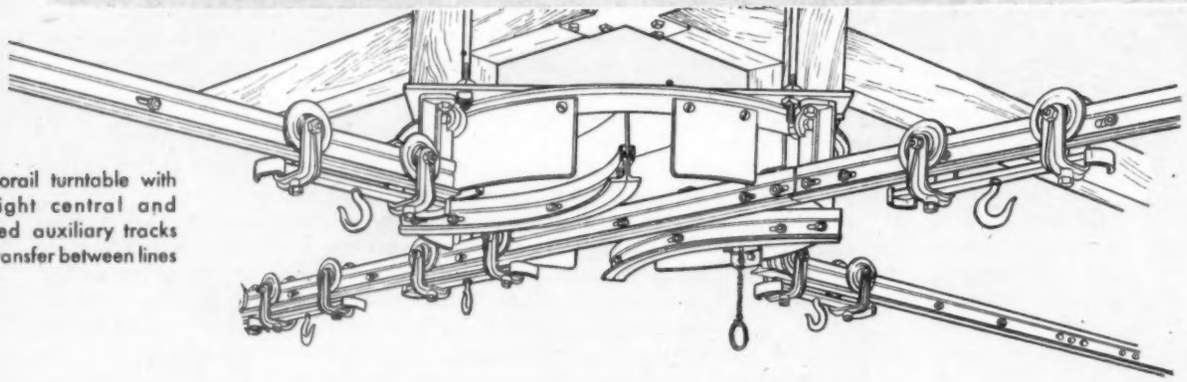
Three types of wheel treads for operation on I-beam track—straight wheels set at an angle, tapered wheels set vertical and straight wheels on raised treads



Monorail transfer, or sliding, switch using two pieces of aligning rail is operated by control rope to route trolleys to either rail

Monorail tongue switch of 3-way type has a positive latch in any position and safety stops attached to the switch tongue to keep trolleys on the rails





Monorail turntable with straight central and curved auxiliary tracks for transfer between lines

MONORAIL CRANES

A widely used system of overhead transportation utilizes an I-beam type of rigid track, designated as monorail, tram-rail, super-track and by other names, according to the manufacturer. The track equipped with various forms of hoists and other carrying devices serves both as a lifting and transporting medium. In its simplest form, a single track can be equipped with a carrier from which a hoist is suspended, or a bridge can be swung between two tracks. In either case the track may be supported on specially constructed trestles or on brackets attached to the building structure.

The wheels of the carriers or crane trucks rest on the lower flanges of the track or on auxiliary rails attached to the track. Three common treads are in use, one having straight wheels set at an angle, another having tapered wheels set vertically and the third having straight wheels riding on raised treads on the lower flange of the track. Advantages claimed for the last type of tread are reduction in bearing friction with consequent ease of operation and avoidance of distortion in the track from the peening or hammering action set up by passage of the wheels. Ordinarily the peening effect tends to cold work and expand the upper surface of the flange, causing the flange to turn down as there is no cold working and like expansion on its lower surfaces.

Hoists operating along a single track may be supported on two- to eight-wheel trolleys and propelled by hand or power. Power propulsion can be effected by spur-gear reduction drives from electric motors through steel drive wheels or a pneumatic tire inflated against the bottom of the track.

In many monorail systems it is advantageous to provide means for the carrier to pass from one track to another. This can be accomplished by a simple latching device that lines up the bridge crane with a spur track or a cross-over. When it is necessary, however, to diverge from a track at an angle, some type of switch is required. It may be a transfer, or sliding, switch that carries two pieces or rail, one being used at a time; a tongue switch of the two- or three-way type; or a rotating switch, or turntable.

Such switches can be operated from the floor, from the cab of a monorail hoist or telpher or by means of photo-electric cells placed to intercept the line of travel.

One of the most outstanding new developments in utilization of monorail systems is adaptation of automatic and manual controls to permit the dispatch of one or more power-driven trolleys to any point over the system. Loads of various types can easily be controlled so that they move between departments, between floors, and even between buildings where they are released automatically at predetermined locations (one or more) from which carriers return to the point of origin.

CONVEYORS

THE PRINCIPAL USE of conveyors is for the continuous movements of materials over fixed lines of travel between fixed points. Wherever there is such repetitive handling over defined paths of travel, continuous conveyors can do the job quickly and dependably, but their other advantages may be of equal or even greater importance. By making it possible to maintain clear aisles and passages, conveyors relieve congestion and contribute to safer working conditions.

Furthermore, the far greater capacity of continuous handling on conveyors reduces demurrage charges on rolling stock and relieves platform elevators of handling work that interferes with their normal functions

Another important advantage is that conveyors coordinate the sequence of production operations without extensive alterations to existing equipment or buildings. Even widely separated departments function as a unit when tied together by correctly timed handling equipment. Timing of conveyor travel paces production.

With the many kinds of conveyors available, practically every materials-handling problem of the fixed-path type can be solved by a conveyor. They are adapted to the handling both of bulk material and of material in unit packages. The latter may be single pieces or a number of pieces assembled as a unit package. Handling of unit packages, the particular problem of metalworking industries, can be accomplished on a number of different types of conveyors, including gravity roller, wheel, spiral, chutes, belt, live roller, trolley chain, floor chain, apron, pusher-bar, vertical tray, reciprocating, pneumatic, automatic and portable.

ROLLER CONVEYORS

Conveying by gravity roller conveyors affords, where it is practical, the simplest and most economical means of transporting material. Initial cost is low, maintenance is negligible, and no power cost is involved. They are adaptable to conveying almost every type of package, container and article, provided there is a reasonably firm and flat surface for contact with the rolls. Besides providing a means for general movement of materials through a plant, roller conveyors also serve to feed work to machines, move it through progressive assembly, and store it between machine or assembly operations.

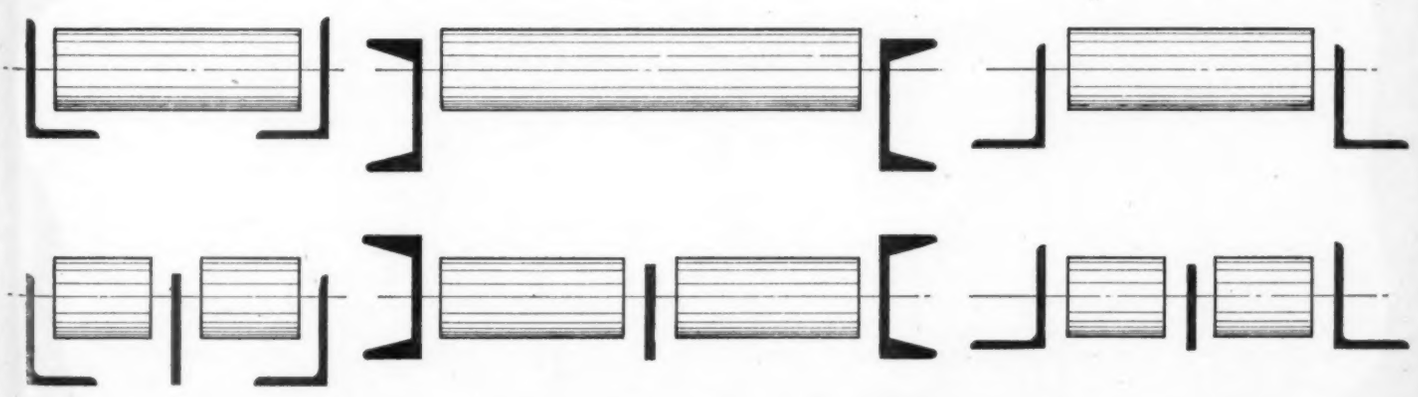
A roller conveyor consists of a series of cylindrical rollers free to revolve between two side frames. The rollers, supported on ball bearings, are spaced close enough together that three rollers are always in contact with the bearing surface of the load. The greater the number of rollers in contact the smoother is the operation.

The length and diameter of the rollers are determined by the size, weight and character of the load. The length may be slightly less than the width of the load, provided overhang is not a detriment, but usually it is from 2 to 3 in. greater than the maximum width to be handled and sufficient to provide clearance on the curves. Diameters range from 1 to 5 9/16 in. and must be selected so that the load per roller is not greater than the rated capacity. If use of a smaller roller is desirable, spacing the rollers closer together may be necessary to reduce the load on each one to a point within its capacity, but the total load should never exceed the sum of the total rated capacities of the supporting roller or the capacity of the frames.

Rollers may be mounted in a single row between two frame rails or in a double row in three frames. The usual construction is the two-rail type, but for conveyor widths over 28 in. the three-rail type provides better operation and an increased bearing capacity to the length of the load. Furthermore, if the rollers are tilted or "cut" slightly toward the center, the three-rail conveyor is self-centering and the load stays on the track without guard rails.

The frames supporting the rollers are of three standard types: flat bar, angle and channel. Flat-bar frames are adapted principally to light or portable conveyors, whereas angle-iron and channel frames are better suited for heavier conveyors or when the rollers are set low to have the frames act as guard rails.

Conveyor sections are made in standard straight lengths of 10 ft. and with 45-, 60- and 90-deg. curves. Longer or shorter sections can be made up to meet any requirements. Each section is equipped with end couplings to connect sections together. Where portability is desired, couplings are of the universal type, where-



Conveyor rollers may be set high to give load clearance or low so frames act as guard rails. Three-rail frames provide better operation and increased bearing capacity

as strap and butt couplings, which form rigid connections, are better for permanent installations.

Two general types of supports are made for roller conveyors, one resting cn the floor and the other suspended from trusses. Floor supports, either stationary or portable, are made of angle iron or channel, and have adjustable legs to secure the desired height, usually up to 6 ft. Stationary supports can be bolted to the floor, whereas portable supports are set on swivel casters to permit moving of conveyor sections where needed or to storage when not in use, thereby effecting a saving floor space. Spacing of supports at 10-ft. intervals usually gives a conveyor line ample support, although load conditions may require closer spacing. When severe shock conditions exist, the rollers may be spring-mounted on auxiliary frames.

Hangers, generally used on permanent installations elevated more than 6 ft., are made of structural members or steel rod threaded for adjustments to the correct grade. They can be fastened to trusses or to the ceiling. Both floor-supported and suspended conveyors may be either single or multiple tiered as desired. The slope, or grade, required to convey by gravity depends on the nature and weight of the load, but usually a grade of 4% (½ in. per ft.) is satisfactory. On suspended conveyors the grade may be increased slightly to insure free travel and avoid blockage on lines that are not easily accessible.

Conveyor Sections

Curved sections are of three types: straight, multi-rail straight and tapered roller. With straight roller curves the surface speed is constant for the full length of the roller and tends to move the load straight ahead, rather than around the curve, and twist it on the conveyor. Turning of the load can be partly overcome by changing the roller lead by placing the outer end of each roller ahead of its true radial position. The multi-rail straight roller curve, also called a differential curve, reduces twisting of the load and permits closer spacing of rollers. The tapered roller curve eliminates entirely any twisting of load as the rollers are tapered to the center of the curve, thus giving a varying surface speed across each roller.

In laying out a roller conveyor system it is often necessary to transfer loads from one line to another. The lines may converge or they may be at right angles. Converging lines may be connected by spur or converging sections, which do not afford positive action except on live rollers, or by switches. Spur sections are of several types, including plain, frog, and spur junctions at different angles. Converging sections include straight frog, 90-deg. frog and straight connecting sections. An arrangement of automatic stops can be provided to prevent possible interference of items at the converging point.

Conveyor Switches

Switch sections can be arranged to connect a single line to two or three lines. The two-way and three-way switches, as they are known, have a center or tongue section pivoted at the end that is connected to the single line and free at the other end to swing laterally on a switch plate. Movement is made either at the section or from a distance by means of a cable, lever arm or an electric motor. Limit stops prevent the switch section from running off its track on the switch plate.

The ordinary pivoted switch cannot serve more than three lines and is not too practical for small pieces because of the unavoidable gap that occurs at the pivoted end and the difficulty of securing proper guard rail connections for the change in direction of travel. To avoid these difficulties, a flexible switch, known as a radial or alligator switch, can be employed. The receiving end of the swinging section is made up of rollers separately mounted so that they remain radial at all times and in proper alinement with each other. Each roller may carry its own guard rail. Radial switches are readily adapted to automatic operation and control by photoelectric cells.

For transferring loads between parallel conveyor lines, transfer cars can be located on tracks running along one end of the lines. Rolls on top of the car receive the load, the car is moved opposite the desired line, and the load discharged for either further movement or storage.

Movement of a load between conveyors running at right angles to each other can be effected by rotary transfer tables or by ball tables. The latter are more readily adapted to production conveyor lines and can be used as work or inspection tables and often with scales as a weighing platform. They consist of hardened steel balls from 1 to 4½ in. in diameter, mounted in steel housings and closely spaced on a solid plate. Spacing of the balls depends on the size, weight and type of piece handled, but at least nine should be in contact with the load. These, too, may be used, pedestal-mounted, for handling large pieces of sheet metal or plate.

Other special devices are available to adapt roller conveyors to particular handling problems. For example when the production sequence in a plant requires a piece to be turned over between operations, as often necessary with engine blocks and similar items, a rollover may be incorporated in the conveyor line.

This consists of a skeleton, cylindrical cage carrying rolls on the inside at top and bottom. The load, fastened in place, is turned over by revolving the cage on its guide wheels. Another special device is a hinged, counterbalanced section that can be raised to permit passageway through the conveyor line. When heavy loads are handled, it may be necessary to employ brakes to control the speed of the loads. The brakes, which bear against the underside of the rolls, may be manually operated or power-operated by air cylinder or electric thrustor.

WHEEL CONVEYORS

Similar in principle to roller conveyors, wheel conveyors afford an economical means of handling material. The wheels are attached to frames and are closely spaced to provide a smooth riding surface. Where conveyor lines are portable and must be moved often, as in loading and unloading cars and trucks, wheel conveyors are well suited because of the lightness of their individual sections. For handling sheet steel and other steel products, heavy-duty wheel conveyors are often applied at the charge and discharge ends of furnaces, on furnace run-out tables and adjacent to shears, sheet pilers and dryers.

SPIRAL CONVEYORS

Spiral (helical) conveyors are of two types: roller spiral conveyors and spiral chutes. Both serve the same purpose of lowering articles from one floor to another, or from a higher level to a lower level, and can be made to serve any number of floors. Loading and unloading stations can be arranged on any or all floors according to requirements.

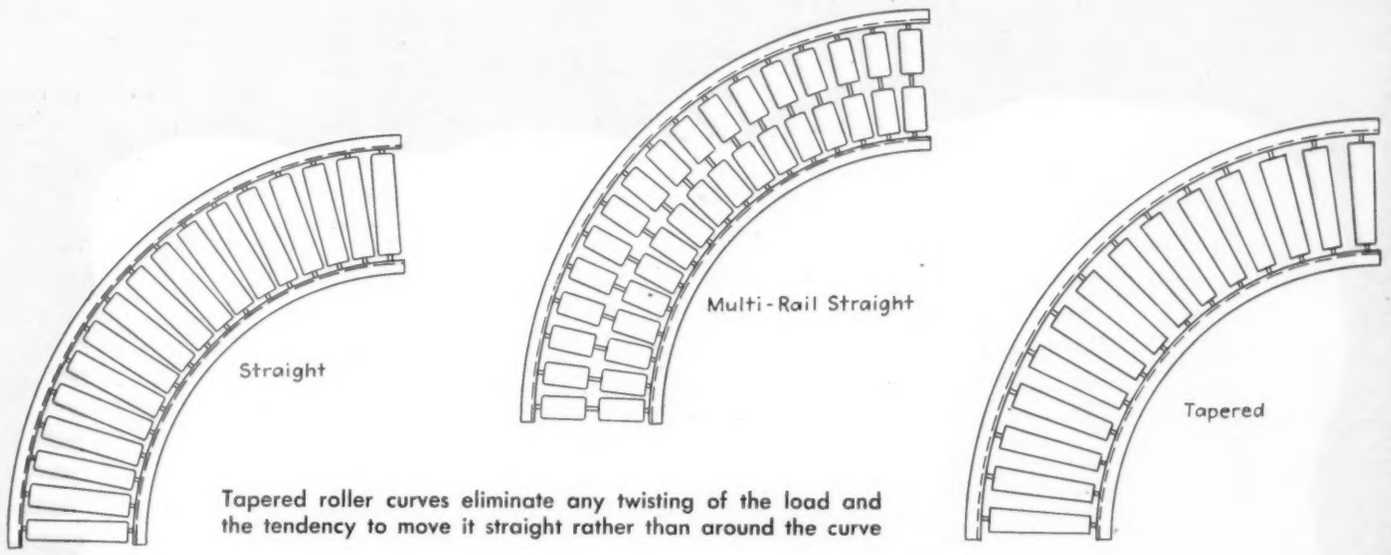
Roller spiral conveyors consist of a number of curved sections of roller conveyor set in the form of a spiral with considerable slope, varying from 5 to 10 deg., and mounted in a structural steel frame. They offer several advantages over other methods of lowering articles in (1) requiring no power, (2) permitting slow and

easy descent, (3) allowing for considerable storage, and (4) conveying open containers or trays without spilling the contents, drums and barrels in an upright position and fragile articles without damage. Of the three standard types—straight, multiple and tapered roller, the last gives the best results as it provides better bearing to the load and reduces friction between load and outer guard rail.

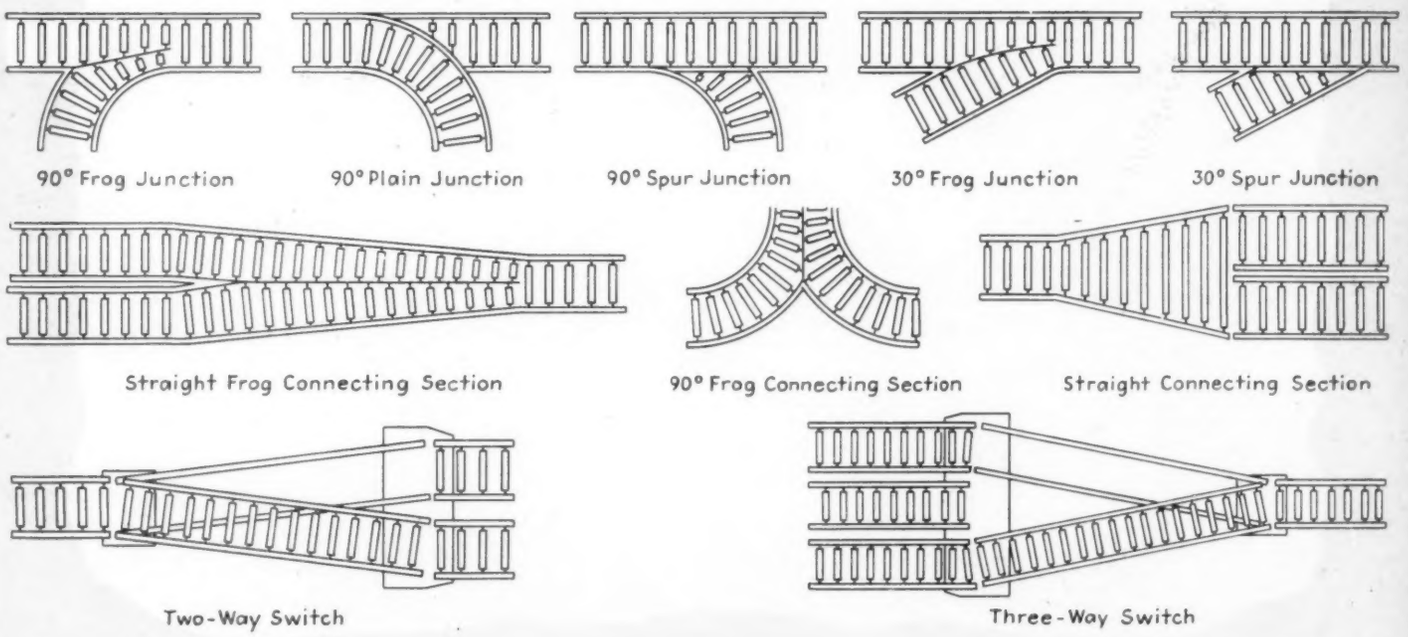
Articles are usually delivered to a roller spiral by a gravity roller conveyor, and can be received or discharged at intermediate points on the spiral by means of frog sections inserted at the desired points or by using a loop at the desired floor. The loop extending out from the spiral permits the straight sections to be used as switches to additional lines of roller conveyor. For a discharge frog section, a portion of the guard rail is arranged to swing over the spiral path to divert the article to a connecting line of roller conveyor.

Straight and spiral chutes, while limited in application because of the steep pitch required to overcome friction, are useful in lowering articles from a higher to a lower level. Straight sheet-metal slides can be adapted into gravity roller conveyor systems to good advantage as they handle the same general class of material. Their pitch is governed by the nature of the material to be conveyed and varies for general requirements from 16 to 30 deg.

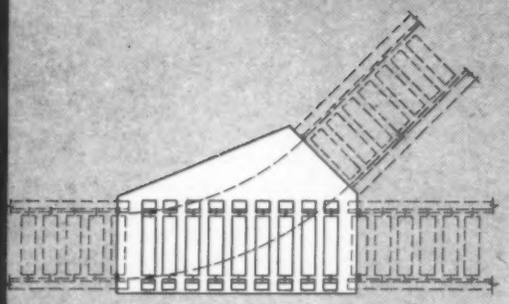
Spiral chutes are made with flat or concave treads, depending on the material conveyed, and may be single, double or triple bladed. The three general types available are the open standpipe, open core and enclosed chutes. In open standpipe chutes, the inner flanges or the reinforcing angle under the inner edge of the blade wings is attached to a central standpipe that acts as the inner guard. Open-core chutes, having no standpipe, must have an inner guard rail for their full length. Enclosed chutes are similar to the open standpipe type, except that a sheet-metal circular shell covers the entire spiral on

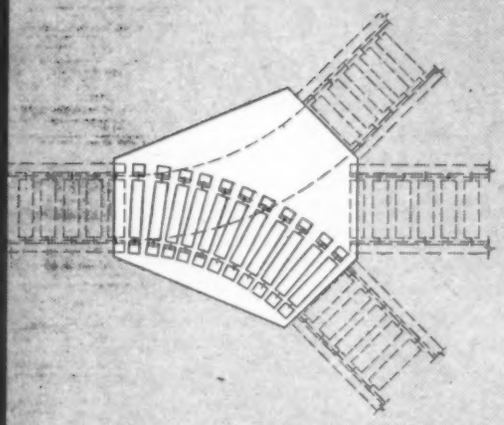


Tapered roller curves eliminate any twisting of the load and the tendency to move it straight rather than around the curve



Transferring loads between conveyor lines is done by junctions, or spurs, sections and switches. Automatic stops can be added to prevent interference between packages





Two and three way radial switches have switch rollers separately mounted in radial positions and eliminate difficulty of securing proper guard rail connections

the enclosed type of spiral chute.

Loading and unloading stations can be provided at any desired intermediate point along the spiral. The receiving and discharging chutes are made as tangential continuations of the spiral chute. On the discharging chute, a hinged deflector is arranged to divert articles from the spiral chute. It is never good practice to use a chute for storage.

Articles that require no exceptionally careful handling, such as boxes, crates, bundles and cases, are handled efficiently by spiral chutes, but when careful handling is necessary, roller spirals are better suited. The nature and size of the article to be conveyed governs selection of a chute and its dimensions and pitch. For general conveying between floors the pitch may vary from 20 to 30 deg.

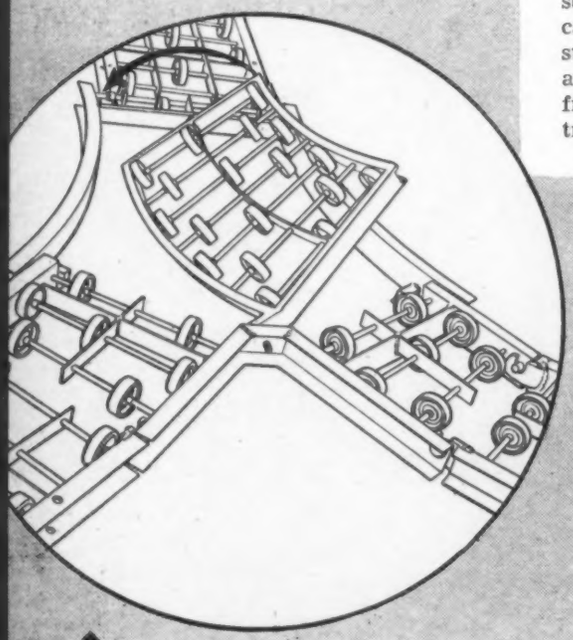
BELT CONVEYORS

Although the most prevalent use for belt conveyors is the handling of bulk material, they have a growing application in package conveying, progressive assembly and inspection operations, and processing of materials. In the metalworking industry, subassemblies or complete assemblies can be moved by belt conveyors from station to station on an assembly line, and parts in process can be moved from one operation to another in trays or tote boxes which may be returned empty on the return side of the belt. Flat belts are particularly adapted to such handling work.

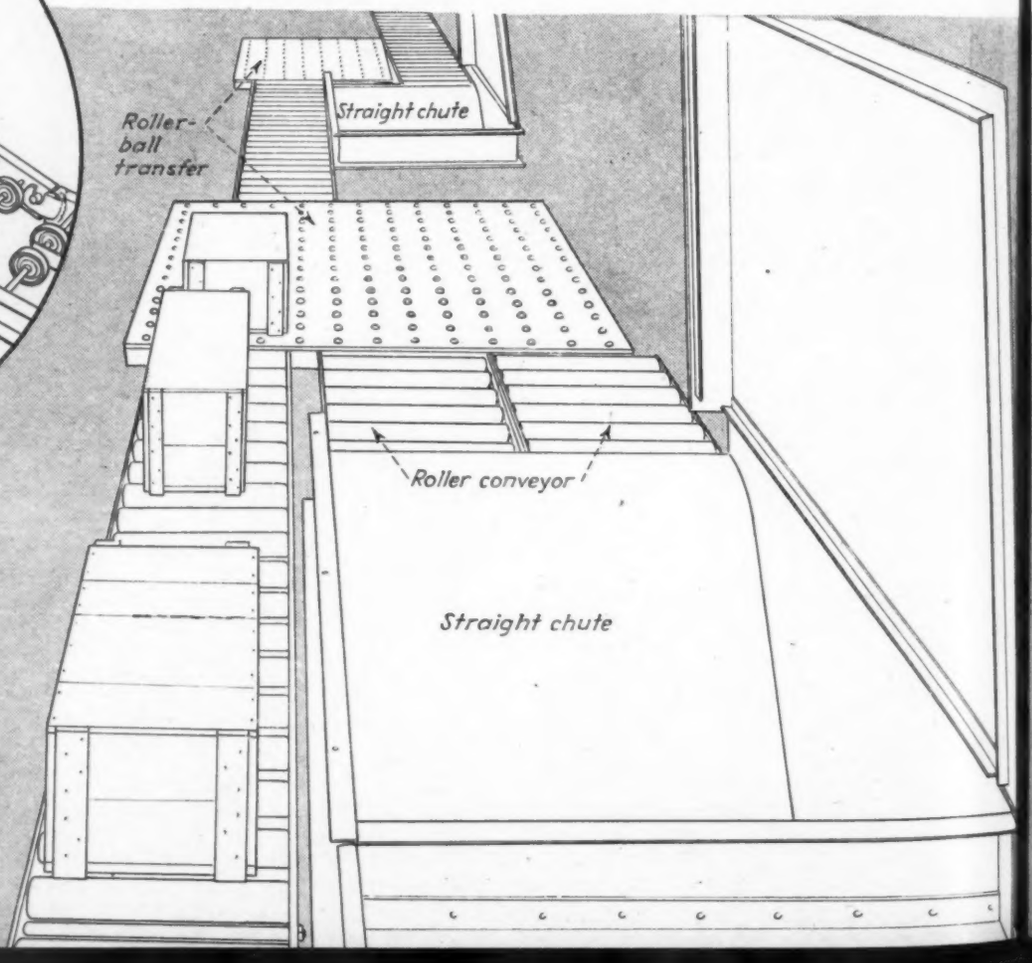
Belt conveyors consist essentially of a carrying belt, intermediate supports for the belt, pulleys, take-ups, guides and a means of driving the belt. They are made level, inclined, declined or as a combination of these features and with stitched canvas, solid woven, rubber covered, duck, steel mat or wire mesh belts. Inclined conveyors with rough top belt operate up to 28-deg. slopes and should have a flat or slightly inclined feeding section for any slope over 15 deg.

The intermediate supports for the belt are usually tread, or carrying, rollers fitted with ball, roller, bronze or oil-impregnated bearings into side frames, or they may be slide beds made of wood or sheet metal. The idlers that support the returning side of the belt are of the roller type, as their use reduces belt friction and wear to a minimum. Spacing of the intermediate idlers varies, according to the nature of the load, from 4-in. up on the carrying surface and from 6 to 10 ft. on the return side.

The type of conveyor drive varies with its speed and the amount of power required. As for ordinary package handling the belt speed ranges from 50 to 100 fpm., a gear motor is suitable for driving the belt drive pulley or power may be applied through a speed reducer from a motor, line shaft or other source.



Portable roller wheel conveyor equipped with a flip switch to provide a quick change in the route of the packages



Roller ball transfer arranged for transfer of articles between roller conveyor lines and feeding to straight sheet-metal chute

The efficiency at which power is transmitted from crown face drive pulley to belt depends on the traction between pulley and belt, and varies with the diameter of the pulley and the arc of contact between their surfaces. To increase the efficiency, pulleys may be lagged by riveting rubber on the face or cementing on asbestos fabric. There are in use five common types of drives: plain pulley, snubbed pulley, double snubbed pulley, tandem, and press roller.

The plain pulley drive has an arc of contact between 135 and 180 deg. and is satisfactory for simple conveyor layouts where the belt is short and loads are light. The snubbed pulley drive increases the arc of contact to from 180 to 245 deg. and can transmit 15% more power than can the plain pulley drive. The double-snubbed pulley drive provides an arc of contact up to 270 deg. and is most satisfactory for heavier installations.

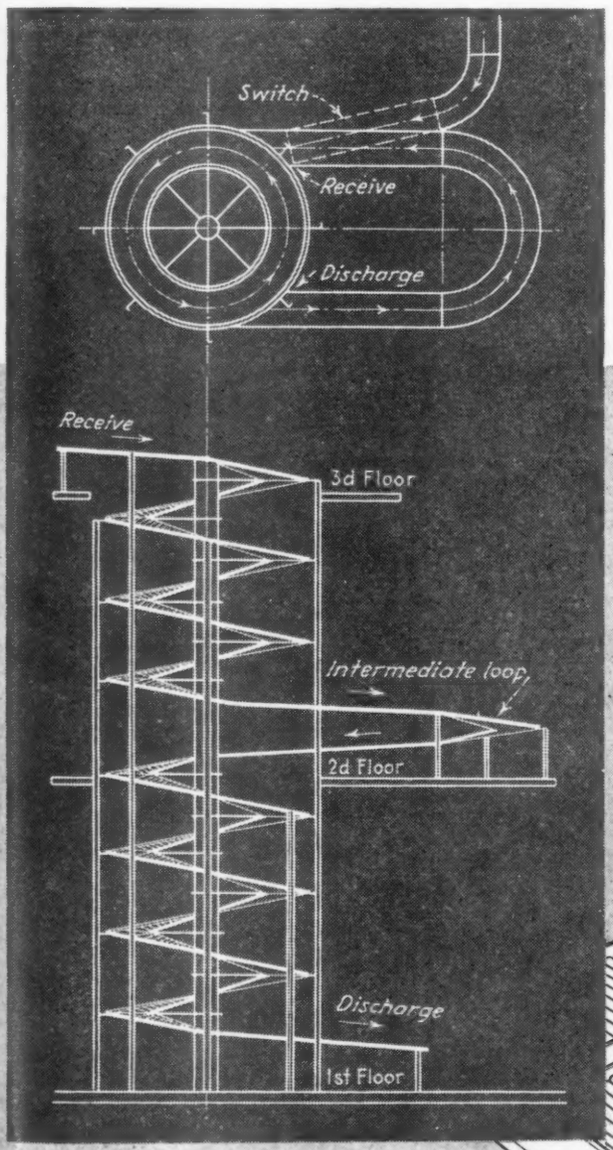
The tandem drive utilizes two drive pulleys, provides a total arc of contact up to 450 deg. and is needed only for those installations where other types of drives cannot produce enough traction. The press roller drive, employed for furnace installations has the drive pulley at the charging end of the conveyor rather than at the discharging end. This arrangement pulls from the cold return, thus relieving tension on the carrying surface in order that there may be a minimum strain on the belt as it passes through the heated chamber. Auxiliary press rollers are arranged to maintain a 180-deg. arc of contact between belt and drive pulley.

All the foregoing drives, except the press roller type, pull the carrying surface of the belt, thus maintaining tension in that side. To adjust the tension in the slack side, a belt take-up of either the screw or counterweight type is placed close to the drive pulley. Screw take-ups are simple, inexpensive and satisfactory for small conveyors, whereas counterweight take-ups are more satisfactory for long conveyors as they automatically maintain a constant predetermined tension under all conditions of load, changes in temperature and stretching of the belt.

LIVE ROLLER CONVEYORS

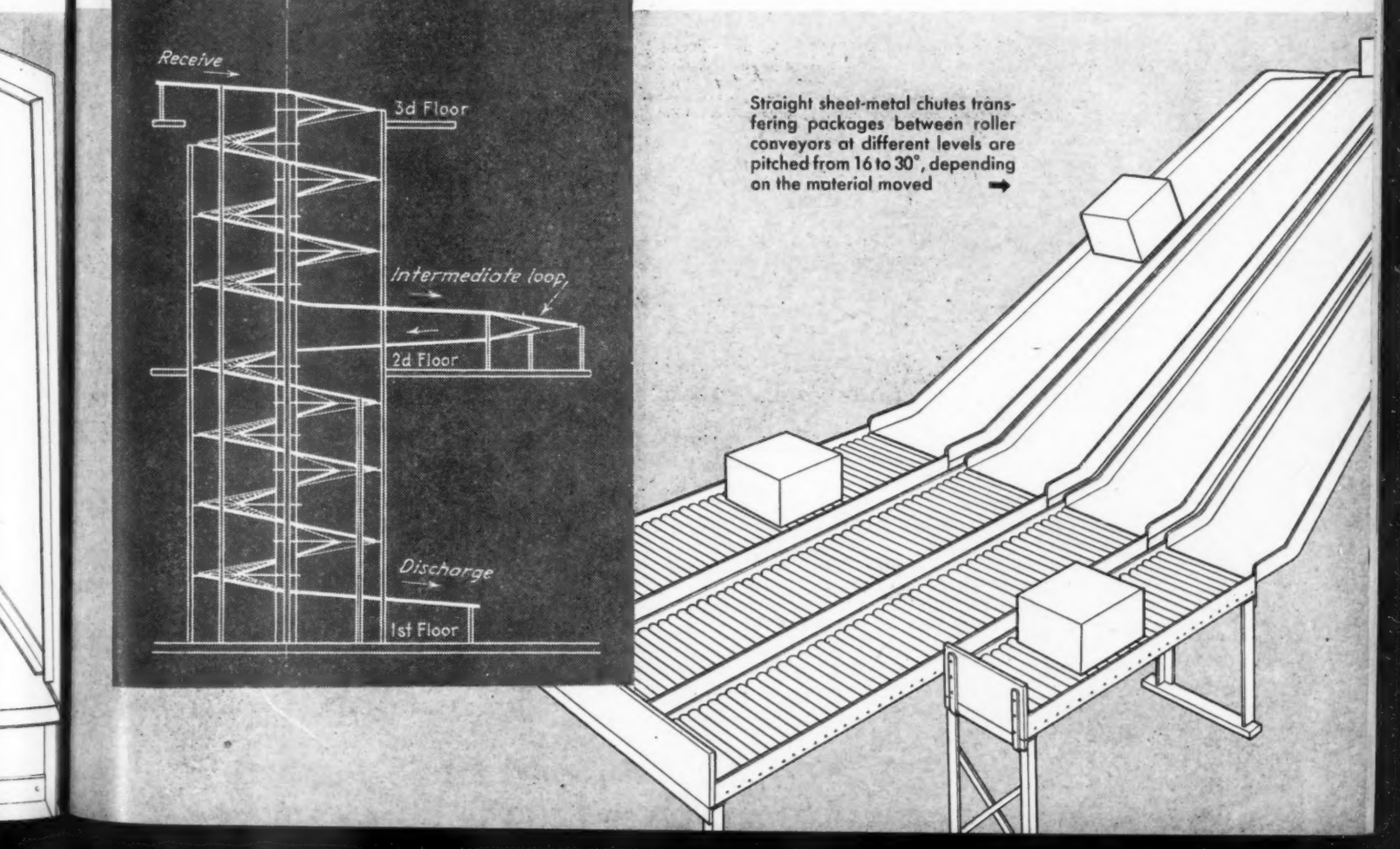
Live roller conveyors differ from gravity conveyors in having the rollers driven from underneath by an endless belt or at their end by chain and sprockets or gears. They are adaptable to rough, hard service but limited, of course, to such articles as roller conveyors can handle. A valuable feature is that packages may be stopped and allowed to accumulate on a conveyor without excessive wear and tear.

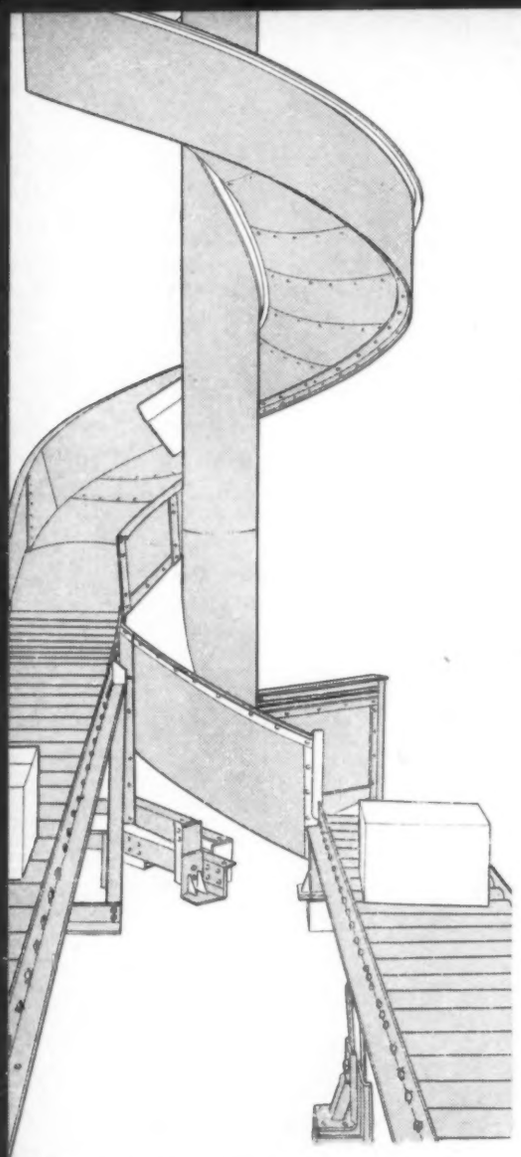
On the belt-driven conveyor the belt is held in contact with the carrying rollers by actuating, or pressure, rollers underneath the belt. Then as the belt is driven, motion is transmitted to the rollers and load. Altogether there are three sets of rollers: closely spaced carrying rollers, actuating rollers spaced as required and widely spaced idler rollers for the belt return. Belt drives and take-ups are similar to those on belt conveyors,



← Roller spiral conveyor arranged with a receiving and discharging intermediate loop lowers articles from higher to lower levels and can be loaded and unloaded at the loop

Straight sheet-metal chutes transfering packages between roller conveyors at different levels are pitched from 16 to 30°, depending on the material moved →





Spiral chute having receiving and discharging station at intermediate floor. A deflector allows discharge to roller conveyor or passage to lower floor

while load deflectors, switches and other features of gravity roller conveyors are adapted to live roller conveyors.

With the chain and gear driven conveyors, the roller action is positive and surface speeds as high as 500 fpm. and more are employed for handling billets, bars and sheet stock. The usual speeds however vary from 50 to 100 fpm. Single- or double-strand roller chain may drive the rolls, depending on the power transmitted. On curved sections, the rollers can be driven by a V-belt with actuating and return rollers, chains from roller to roller, spur gears connecting the rollers or miter gears chain driven.

TROLLEY CHAIN CONVEYORS

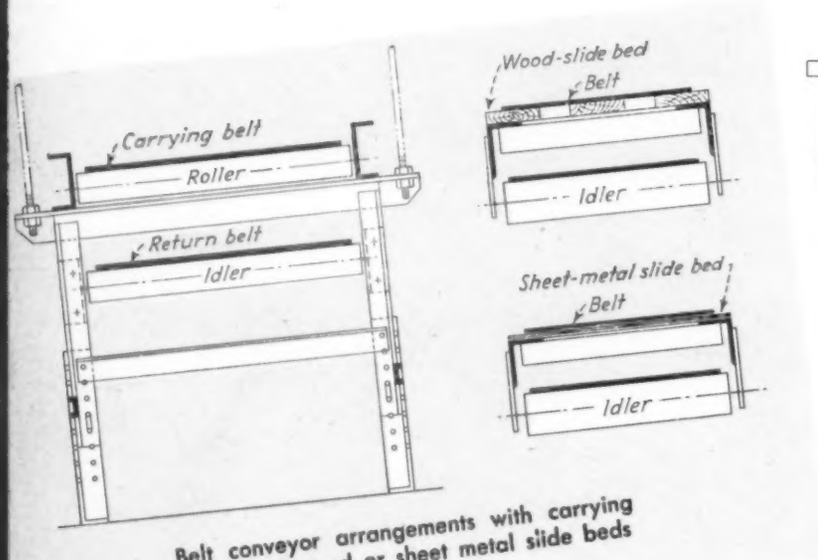
Adapted to conveyor as well as crane operation, single I-beam track can be equipped with suitable carriers and an endless chain drive to form the overhead trolley chain conveyor. This conveyor is a simple, flexible and economical device for conveying material from point to point on a fixed line of travel. It makes the ceiling pay dividends by saving floor space, avoiding floor congestion, permitting straight-line production without costly remodeling of the building structure.

Trolley conveyors are of special value in carrying parts from operation to operation and through processing, feeding assembly lines, moving parts through final assembly and to storage or to the shipping dock, conveying all types of material from floor to floor or building to building, and serving as a mobile storage from which a steady supply of materials flows to machines or assembly points. They are particularly adapted to production lines on such items as automobiles, refrigerators and washing machines.

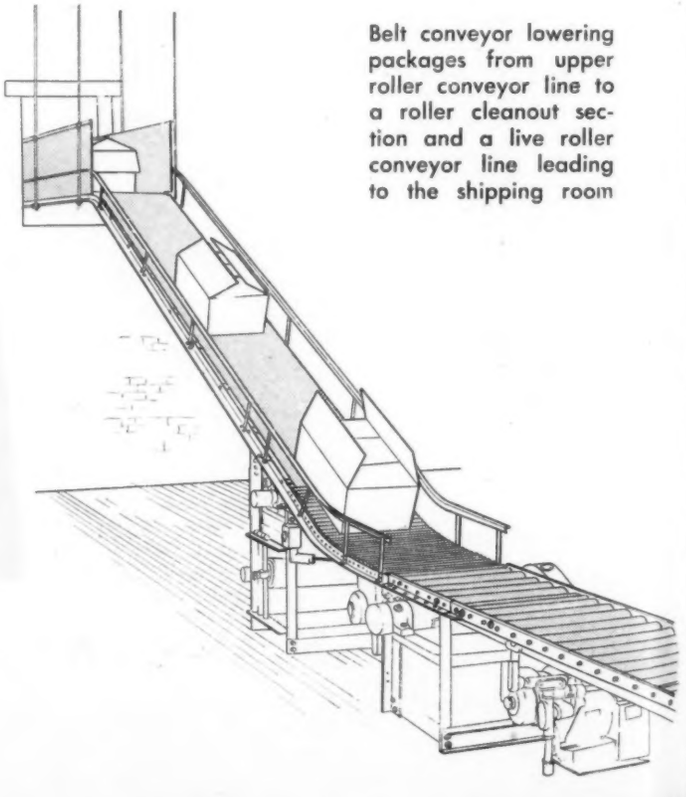
Where floor space is at a minimum, trolley conveyors travel overhead, dropping to predetermined points to permit parts to be removed from or placed on their hooks or trays. In this way headroom in working areas and aisleway clearance are secured without hindering production operations. Floor space too is saved by mounting ovens and furnaces near the ceiling and moving parts through them on trolley conveyors.

The trolley conveyor is arranged as an endless circuit of monorail track beneath which moves an endless chain connected to trolleys at regular intervals of 8 to 36 in. The trolleys carry loads by means of hooks, racks, special carriers or suspended trays. The line of travel may include horizontal bends up to 180 deg. and inclines up to 45 deg., depending on spacing of trolleys and load carried. Special installations have been made where the load is also carried vertically.

Conveyor trolleys are made up of ball or roller bearing wheels operating on the lower flange of the I-beam and connected through forged yokes to the conveyor chain. The chain is guided on horizontal turns either by



Belt conveyor arrangements with carrying rollers and wood or sheet metal slide beds



Belt conveyor lowering packages from upper roller conveyor line to a roller cleanout section and a live roller conveyor line leading to the shipping room

a sprocket, a traction wheel or more often a series of rollers closely spaced. On vertical bends the path of the chain is fixed by the action of the moving trolleys and should be made as large as possible, standard practice being a radius of 15 ft.

The chain must be flexible enough to curve against the chain pins, that is, in the plane opposite to the usual plane of chain flexure. A number of chains can do this satisfactorily, but drop-forged, rivetless chain of 3-, 4- and 6-in. pitch are best adapted for this purpose. The chain is carried with pins vertical, and the trolleys are attached to the middle of the single links. Operation of this type of chain around vertical bends is satisfactory with an adequate bend radius.

The conveyor chain is usually driven by a sprocket on the drive shaft of a variable- or constant-speed single driving unit located at a 90- or 180-deg. turn and preferably at the highest point in the system. A vertical curve immediately after the drive allows any slack in the chain to fall away from the driving unit. Otherwise a take-up unit is necessary to maintain proper tension in the chain.

When the nature of the load requires large radii on all turns, a caterpillar drive is substituted. This drive operates an auxiliary chain running parallel to the conveyor chain and carrying dogs that engage the links of the driven chain. Speeds vary from a few inches up to 150 fpm., depending on the requirements.

Semi-automatic operation can be attained on a trolley conveyor by use of automatic discharge or dumping stations for trays, upending and loading devices and automatic transfers. The load-carrying hooks or trays can easily be adapted to these automatic devices and may be made up to any shape or form required by the load.

FLOOR CHAIN CONVEYORS

Chain-operated floor conveyors have a wide application for moving material from one department to another and through processing, and are adapted to the mechanization of assembly lines. The chain may form the actual carrying surface for the material handled, as in the case of a billet annealing furnace or a dryer for pickled sheets, or it may simply furnish the motive power for moving dollies, trucks and pallets. Although designated as a floor conveyor, it may run in any direction—vertically, horizontally or inclined. The driving units are similar to those used for trolley conveyors, being either motor-driven sprockets or of the caterpillar type.

Apron, slat, or pallet conveyors are probably the most widely used of the chain conveyors, being adaptable to handling commodities of such nature or weight unsuitable for other types of conveyors and to the progressive assembly of such items as refrigerators.

The conveyor is arranged as a continuous traveling platform mounted in a steel framework on two strands of chain or on dolly wheels with a chain drive. The platform is made up of a series of slats consisting of hardwood slats, steel plates, steel channels, or rollers when it is desirable to stop the load on the conveyor. Like a belt conveyor, the platform is endless as it passes over end sprockets and returns on a lower level.

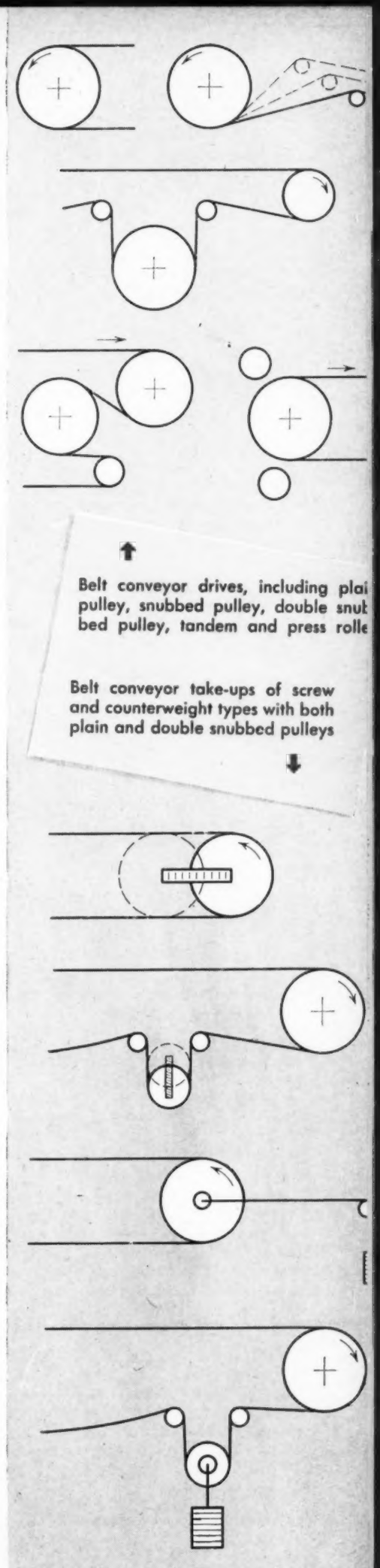
The maximum angle of inclination is approximately 10 deg. with a plain slat, but the angle can be increased to 45 deg. by the use of cleats or flights, depending on the type of material. For handling bulk material and small parts, the slats are overlapped to form a tight apron. Chain speeds are generally from 30 to 40 fpm., but can be increased to 100 fpm.

When it is necessary to stop materials in transit, roller slat conveyors can be used to advantage. The rolls are mounted between two strands of chain at various centers so as to form a continuous traveling bed. Little friction is developed as the rolls turn only when the load is stopped.

Pusher-Bar Conveyors

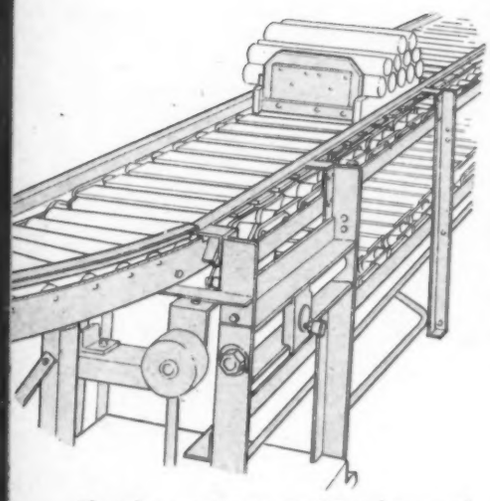
For elevating or lowering at angles from 30 to 60 deg. or greater, pusher-bar conveyors are generally the best type to use. Also they are simple to operate, have a low initial cost and are easily adapted to automatic loading. Sometimes known as booster conveyors, they are used extensively in gravity roller conveyor systems to elevate packages from one section of the roller conveyor to the next.

They are made in two types—the roller bed and the slider bed. The roller-bed conveyor has rolls similar to those on a gravity system and pusher bars inserted at intervals to move the packages. The bars are connected to an endless chain on each side to provide motive power. The slider-bed conveyor has similar pusher bars, but the packages slide over a stationary sheet-steel bed. Pusher-bar conveyors operate at an average speed of 40 fpm., giving an approximate capacity of 10 units per min. with pusher bars spaced 4 ft. apart.

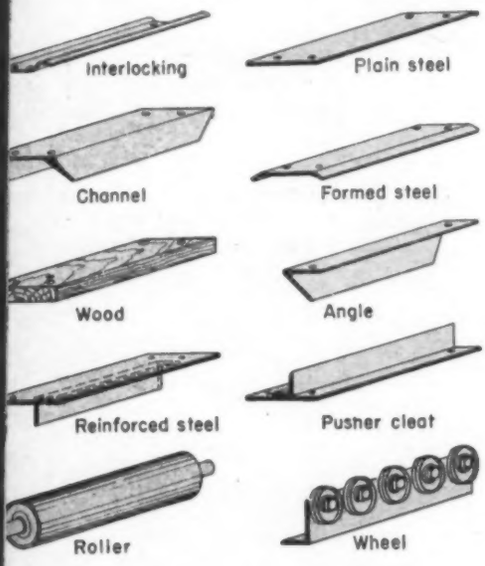


Belt conveyor drives, including plai pulley, snubbed pulley, double snut bed pulley, tandem and press rolle

Belt conveyor take-ups of screw and counterweight types with both plain and double snubbed pulleys



Flat slat conveyor receiving bar stock from roller conveyor and delivering it by use of carriers to next operation



Different styles of slats, or pallets, for slat conveyors

VERTICAL CONVEYORS

Different types of vertical conveyors and elevators for moving materials form floor to floor include the ordinary power-operated elevators used particularly with truck operation, bucket elevators for bulk material and small parts, rigid arm conveyors, suspended-tray conveyors and reciprocating conveyors, or hoists. Bucket elevators consist of buckets mounted on and carried by one or more strands of chain or belt. The buckets pick up the material in a boot at the bottom and discharge it as they pass over the head wheel.

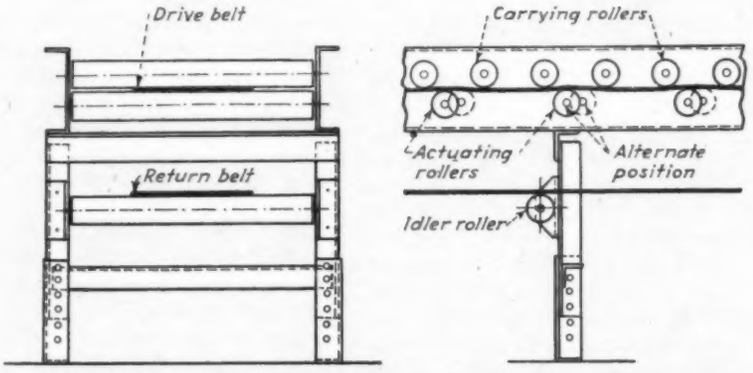
Rigid arm conveyors are the simplest type for elevating or lowering packages vertically or at high angles. Packages can be picked up automatically with finger-arm carriers from loading fingers or stations at any floor and discharged at the desired floor by self-dumping arms. For boxes, cartons and bundles, elevator speeds range from 30 to 40 fpm.

Suspended-tray conveyors, consisting of a series of pivoted suspended trays attached to one or two strands of endless chain running over top and bottom sprockets, may be loaded and unloaded by hand or adapted to automatic operation. With automatic features, the tray has projecting fingers that pick up the load and delivers it on the downside to intercepting fingers at the discharge floor. Tray spacing is usually from 5 to 15 ft. and speeds vary from 30 to 70 fpm.

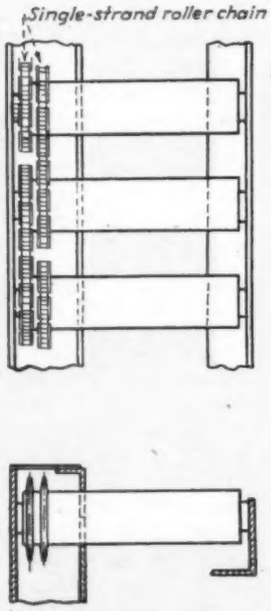
Reciprocating vertical conveyors, or hoists, are not continuous in operation as are arm and suspended-tray conveyors, but offer an economical means of transferring packages, boxes, cartons and materials on casters or pallets. Such conveyors are provided with either roller or open beds. With roller beds, loading and discharging can be automatic from and to roller conveyors. As packages roll on the carrier, they strike a limit switch that starts the carrier up. Another limit switch stops the carrier and as the packages roll out, they strike another limit switch that starts the carrier down to the loading point.

The maximum practical speed at which accurate stoppage can be maintained within close limits is approximately 60 fpm.

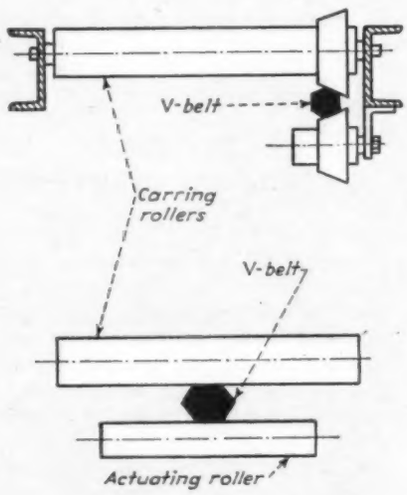
Another type of elevator utilizes a hydraulic lifting cylinder to raise platforms and conveyor sections. It may be used as an adjustable-height sidewalk or shipping platform for loading and unloading trucks and cars, or for raising work to the proper level for feeding into shears, press brakes and other machines. This type of elevator is easy and inexpensive to operate, has a moderate initial cost and can be adapted to many uses throughout a plant, both in materials handling and production work.



Belt-driven live roller conveyor showing relative positions of carrying, actuating and idler rolls as to drive and return sides of belt



Chain-driven live roller conveyor. Both roller to roller or continuous chain drives are used



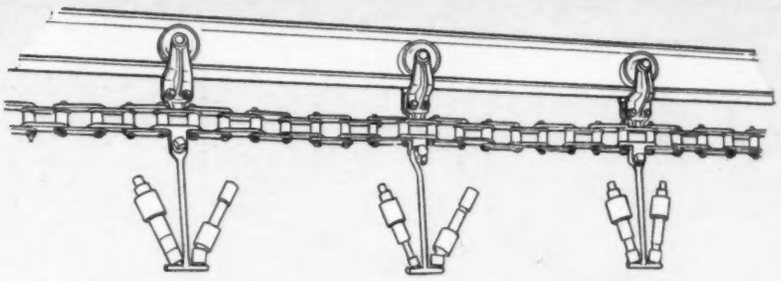
Two types of V-belt drives on live roller curves

MISCELLANEOUS CONVEYORS

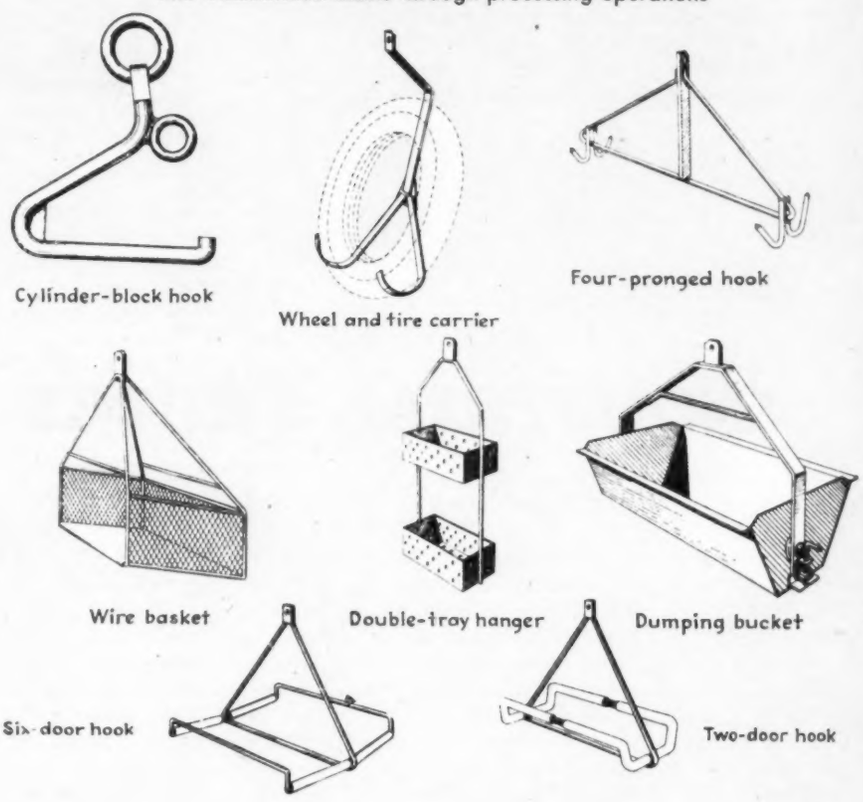
Pneumatic conveyors have been developed to handle packages by propulsion through tubes, with compressed air or a vacuum as the propelling force. In manufacturing plants, they provide a rapid and inexpensive means of handling papers, blueprints, and small tools and parts between toolrooms or stockrooms and machines. The size of the traveling container depends on the size of the objects handled.

Operations, such as pickling, cleaning, heat treating and plating, can be performed most advantageously by conveying parts through the process on automatic conveyors. These are made in three types—return, straight-line and dwell. Return conveyors are designed for loading and unloading at the same station, whereas straight-line and dwell conveyors load at one end and discharge at the opposite end of the process. In the return and straight-line types, the work travels at a constant speed through the treatments, while in the dwell type the work is brought to a standstill in each treatment for a predetermined length of time by means of limit switches and time relays.

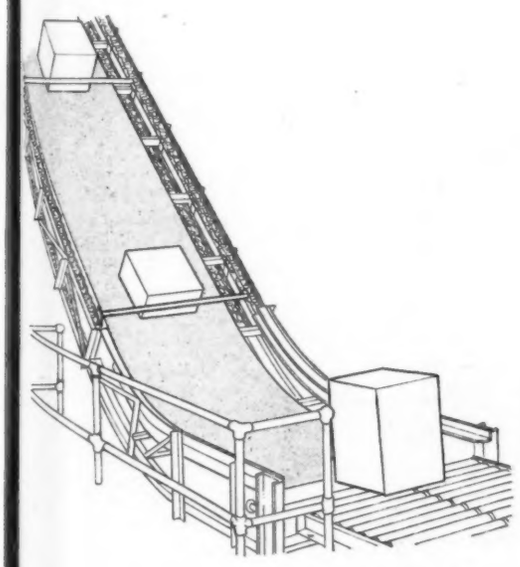
Straight-line and dwell conveyors are equipped with a separate set of chains for conveying the empty work carriers back to the loading end at a speed greater than that of the regular conveying chain.



Trolley chain conveyor utilized to carry automobile transmission shafts through processing operations



Typical trolley chain conveyor hooks and carriers



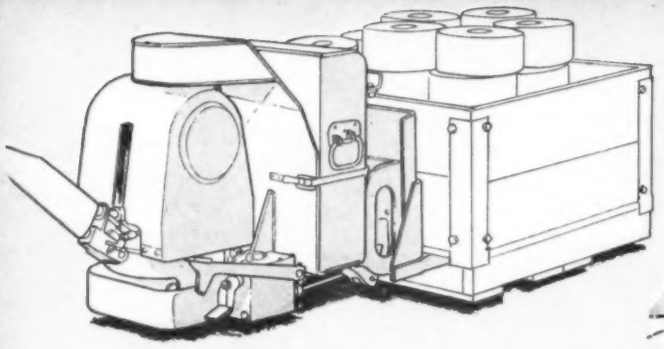
Pusher-bar conveyor has pusher bars connected to traveling endless chains for elevating parts and packages to higher levels

Inherent advantages of automatic conveyors are the possible reduction in cost per unit by elimination of individual handling between treatments, increased production resulting from the constant flow of work, savings in floor space, fewer rejections and lower labor cost. A further advantage, especially in high-speed plating, is attained by oscillating the work while it is in the processing solution.

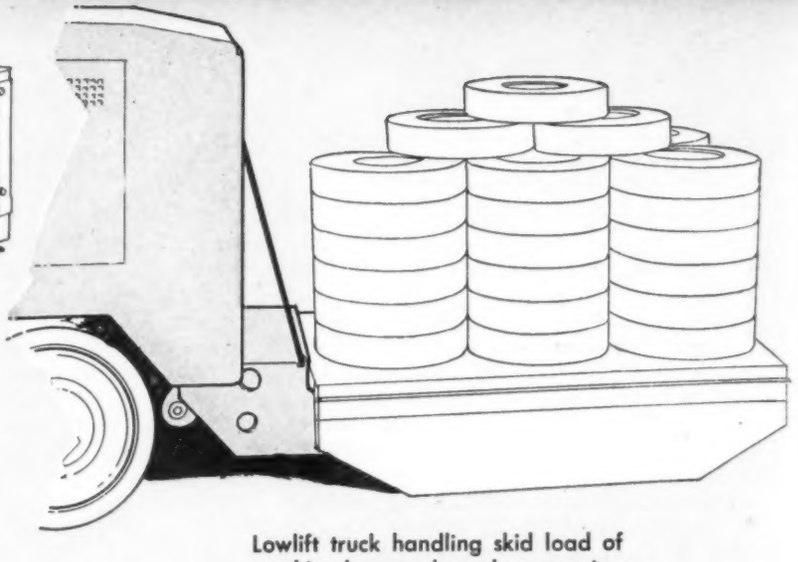
This can be done by imparting a horizontal oscillation by actuating the cross-bar supports with a crank, a vertical oscillation by a short up and down stroke or a longitudinal oscillation by reciprocating the carriers parallel to the chain.

Some applications, such as loading or unloading cars, require the use of portable conveyors. These may be made of several types—roller, wheel or belt. Their operation is similar to that of stationary conveyors, but they can be moved to locations requiring temporary conveyor setups. To facilitate portability they are made light in weight and are supported on casters or adjustable stands. Portable roller and wheel conveyors, like the stationary ones, are available in standard straight and curved sections with suitable switching arrangements, stops and guard rails. One type of roller conveyor, known as an accordion conveyor, is flexible throughout its length and can be curved, even in S curves, to meet conveying conditions.

Portable belt conveyors are also mounted on casters and are adjustable in inclination to suit a variety of jobs. A frequent application is as a booster in a temporary setup of portable roller or wheel conveyors in receiving or shipping materials.



Motorized hand trucks speed up departmental handling of skids or pallets and are especially useful where floor loads and elevators have limited capacity.



Lowlift truck handling skid load of machined parts through processing

INDUSTRIAL TRUCKS

INDUSTRIAL TRUCKS offer a flexible means of handling materials for intermittent moves, regardless of the limits of any one building or bay, uniformity of loads and rates, and cross traffic. So flexible in operation are they that integration of the industrial-truck system with crane or conveyor systems most frequently offers the solution to all handing problems within a plant. For receiving, shipping, storing and moving material throughout the plant—for each such handling operation, there is a type of truck equipment that provides efficient, inexpensive performance.

Among the advantages afforded by industrial trucks are a rapid movement of materials, reduction as high as 90% below costs of manual handling, elimination of handling individual pieces, reduction in spoiled work and damaged goods, maximum utilization of storage space by tiering to the ceiling, reduced time and cost of taking inventories and a definite increase in production by reduction of handling and rehandling time.

Truck Systems

Industrial-truck equipment is classified as (1) hand trucks and (2) power trucks and accessories. The latter are utilized in a number of basic handling systems:

(1) *Tractor-trailer system,* which is for hauling only, as it has no self-contained means of loading or unloading. With the tractor supplying only motive power and the trailers serving only as carriers, the material must be loaded and unloaded by hand, crane or self-loading truck. The major advantage of the system is the low cost per ton moved because of the low initial cost of trailers and their relatively small dead weight. It therefore finds its major application in moving large quantities of material over relatively long distances.

(2) *Platform-truck system,* which is also for hauling only, as loading and unloading must be done by another means. Non-elevating platform trucks are used principally in departments equipped with cranes and are the natural choice for transporting a limited number of loads over long distances.

(3) *Lowlift - truck - skid system,* which contains within itself means of picking up, transporting and setting down with no manual or other handling. The system is economical as it eliminates rehandling, and is in wide use when the job requires only moving relatively short distances and no tiering. The material is carried on skid platforms which are handled entirely by trucks. Thus a skid loaded with parts can be brought to a machine and, as the parts are finished, they can be loaded by the machine operator directly on another skid for removal to the next operation or to storage.

(4) *Highlift-truck-skid system,* which is similar to the lowlift-truck-skid system, except that highlift trucks can be extended to tier loaded skids in storage.

(5) *Fork-truck-pallet system,* which is similar in principle to the lift-truck-skid system. The truck having lifting forks instead of an elevating platform can handle work platforms of less clearance and therefore are used with pallets instead of skids. The pallets on which the load is carried need have only 1/3 to ½ the height of skids and can be made with double faces for tiering purposes.

HAND TRUCKS

Although industrial-truck systems employ power trucks as the principal equipment, hand trucks too are important as they often are most economical for a particular operation. The most common type is the two-wheel stevedore truck used principally for moving cases, bags and barrels. Somewhat larger but used for the same purposes, factory trucks have a platform supported on wheels that may be arranged in various ways. These trucks may be equipped with any one of a variety of superstructures that are adapted for handling materials of different shapes and sizes.

A more complicated truck is the hand lift truck that may have a platform to handle skids or forks to handle pallets. Used in conjunction with power trucks, hand lift trucks make the handling system more flexible, provide means of storing with small aisle space and faciltate moving of skids or pallets within a department without waiting for a power truck.

Hand lift trucks may be of the jack-lift type in which the load is raised mechanically by pumping of the handle, or of the hydraulic type. The latter may be operated by either handle or foot-pedal control. Hydraulic operation insures easy lifting, permits greater capacities and reduces trucking time. Variations include die trucks and hand-operated stackers.

Hand lift trucks may also be equipped with electric drives to speed up handling, especially at distances over 30 ft. within a department, and reduce operators' fatigue. Available in capacities up to 3 tons, they may even release power trucks for other operations. As they are considerably lighter, they can operate over floors or decks that would not support powered lift or fork trucks. As their turning radius is small, pallets or skids may be stored with them from aisles as narrow as 7 ft. Such motorized trucks may also be of the high-lift type and employed for tiering, loading automobile trucks, handling large pieces on and off machines and as a portable elevator or stacker.

POWER TRUCKS

Power trucks of the low and high lift types are similar in construction except for the elevating features. Lowlift trucks have maximum lifts to approximately 24 in., whereas high-lift have lifts to about 70 in. When equipped with telescopic features, the latter can raise loads to 10 ft. or more for tiering and yet collapse to an overall height of 83 in. for passage through doorways and into elevators and box cars.

Elevating of the platform is accomplished by a hydraulic ram actuated by an oil pump or by double chains sprocket-driven from an electric motor through a gear reducer. Speed of hoisting ranges from 10 to 20 fpm., depending on the load and the capacity of the truck, while traveling speeds average 5 to 6 mph. Both hoisting and traveling mechanisms are equipped with adequate controls to provide safe operation.

Fork Trucks

Fork trucks differ from lift trucks in having load-carrying forks and a tilting mechanism on the load rack, 10 to 15 deg. forward and 3 to 5 deg. backward, to cradle the load and to facilitate unloading. Their driving and other hoisting features are practically the same. The forks are adapted to the characteristics of the material to be handled. Standard pallet forks, as generally supplied on fork trucks, are intended, as the name implies, for handling pallets carrying *palletized* loads.

While some packages not on pallets may be picked up with pallet forks, usually chisel point forks are better suited for such service. For handling coils of steel or wire or pipes of large diameter, a rigid ram may be substituted for the forks, thus converting to a ram truck. Similarly, for some loads better suited to handling by crane, a hook attachment is available. For extra long loads, fork extensions may be fitted over the standard forks.

Lift and fork trucks may be classified as: (1) battery-electric which is powered by a storage battery and employs electrical control and transmission, (2) gas-electric which has an engine-generator but is otherwise the same as the battery-electric, and (3) gas-mechanical which has a gasoline engine and mechanical control and transmission. Selection is determined by operating conditions, cost, safety and dependability.

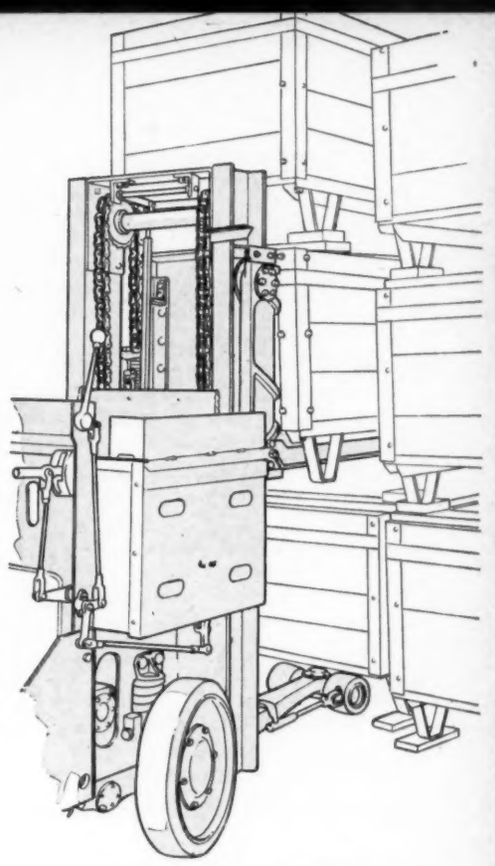
Comparison of Trucks

Battery-electrics are considered the safest as they present less fire and fume hazards than do the others, and in most applications they show lower operating costs. The average operating costs of the three types are in a ratio of two, three and four for battery-electric, gas-electric and gas-mechanical respectively, not considering driver's wages. The greater economy of battery-electric trucks is due to lower maintenance and depreciation charges and to the waste occasioned by idling gasoline engines during brief stops. Furthermore, as battery-electric trucks are considered more dependable and require less maintenance time, fewer trucks are needed to carry on an operation.

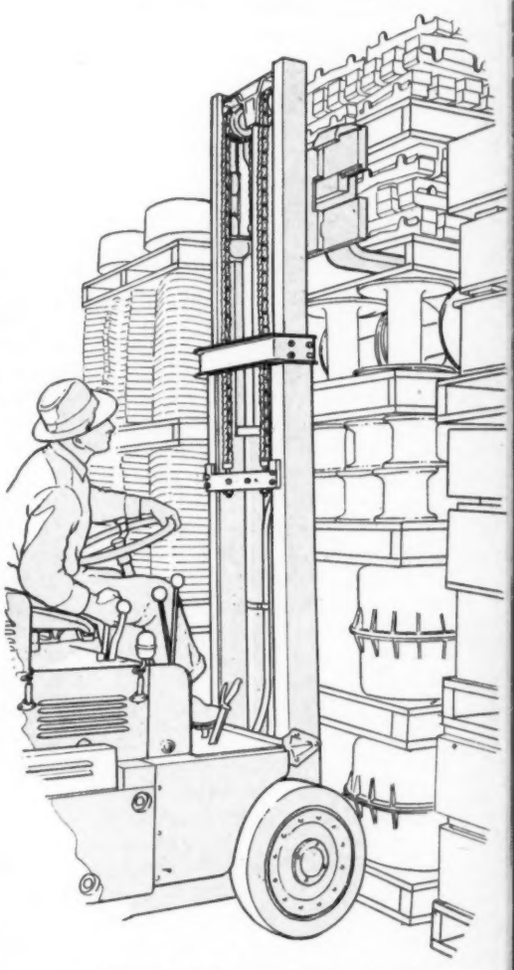
Gas-mechanical trucks are particularly useful where they are moved from point to point and cannot be kept at the charging station. Also, for light and intermittent service they show a somewhat less unfavorable comparison in operating costs. By intermittent service is meant continuous operation for one or two days a week, not the usual intermittent use with idle periods at frequent stops.

Gas-electric trucks find their best field of application in similar service. Like battery-electric trucks, they have an electric transmission which is considered more efficient, especially for starting heavy loads, than that of the gas-mechanical truck.

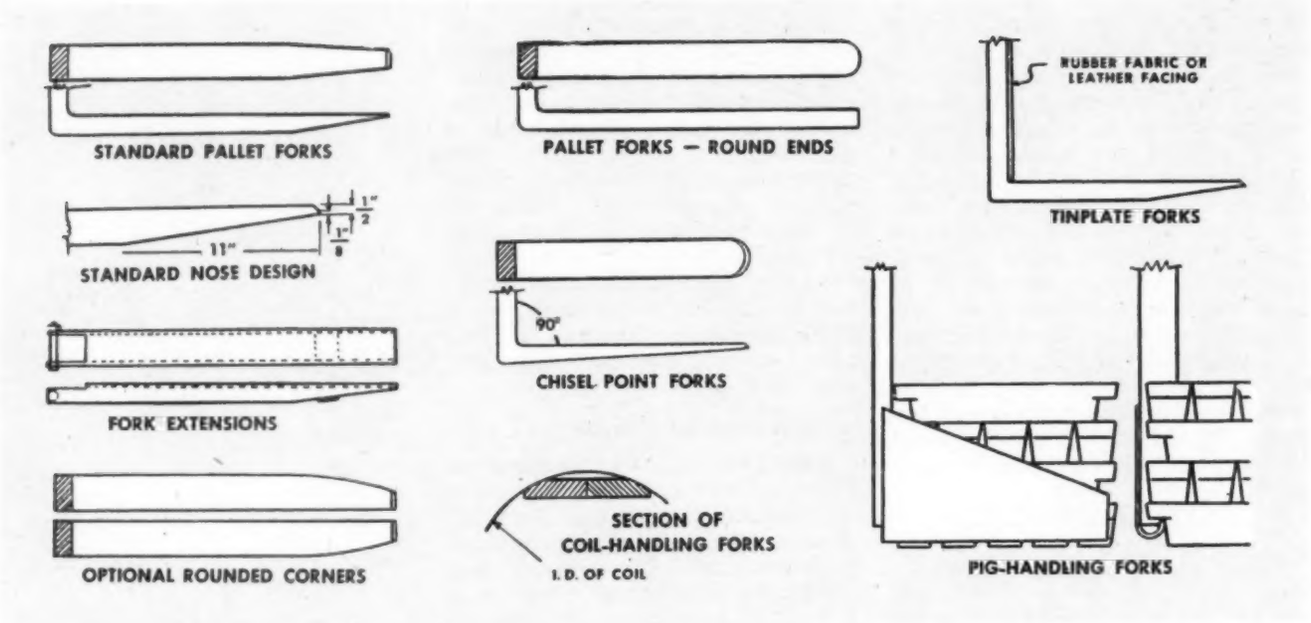
In case gas-electric or gas-mechanical trucks are operated indoors, certain minimum standards of ventilation must be observed to control carbon-monoxide fumes. The average exhaust gas, containing 7% carbon monoxide, will pollute the air in poorly ventilated places to a point dangerous to life. In such places ventilating equipment should be installed and equipped to operate by carbon-monoxide alarms when the concentration of gases reaches 0.02% or 2 parts in 10,000.



Highlift truck tiering box skid loads of small and medium size parts



Fork truck tiering pallet loads of a wide variety of shapes and sizes



VARIOUS TYPES OF FORKS FOR USE ON FORK TRUCKS FOR HANDLING BOTH PALLETS AND INDIVIDUAL LOADS

SKIDS AND PALLETS

Skid platforms may be made of wood with steel frames or entirely of steel. The former have flat, replaceable hardwood tops and are suitable for general service. When skids are exposed to heat or to extremely heavy service, however, all-steel skids are more satisfactory.

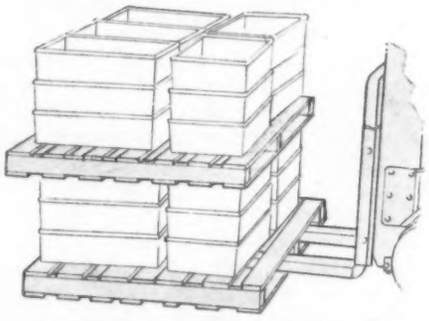
The capacity of skids to handle small parts that cannot be stacked solidly can be increased by box or stake equipment. Box skids may be built solid or detachable, and may have sliding or swinging end doors for unloading small parts that may be dumped without danger of breakage. Skids equipped with side pockets for wood, channel or pipe stakes are recommended for handling bars, pipe and rods.

A skid, equipped with wheels and known as a live skid, is useful for moving parts in process for short distances. It may have four wheels and be pushed by hand, or it may have two wheels at one end with two regular skid legs at the other and be moved by a lift jack raising the dead end.

Pallets for use with fork trucks are made single or double faced and of wood, steel, wood reinforced with steel, aluminum or fiber board. While steel pallets have a higher initial cost, their longer life and non-warping quality offset their higher cost. When goods are shipped on pallets, however, the less expensive wooden pallets or the lighter aluminum pallets are preferred. Choice of a pallet, as well as its design and construction, depends on the given service.

Single-faced pallets are generally used for shipping, except when heavy loads might cause them to collapse, whereas double-faced pallets are better adapted to service within a plant, especially where tiering is necessary. In either case, the under clearance of the single-faced pallet and the opening between faces of the double-faced pallet should be approximately 4 in. to permit quick insertion of the handling forks. Double-faced pallets may be two, four or eight way, depending on the number of ways the forks can enter, as determined by position of the stringers and blocks used in place of stringers.

The upper face of double-faced pallets may be solid or spaced, but the lower face should have standard openings and chamfered edges to accommodate the wheels of hand pallet trucks. Some pallets are made with openings as small as 6½ in., but the Electric Industrial Truck Association recommends openings of 8 to 8½ in.



Fork truck adapted to pallet handling of trays of small parts through manufacturing operations

Wooden pallets may be made of either soft or hard woods, depending on the service requirements. Satisfactory soft woods are pine, fir, hemlock, spruce or chestnut, whereas the hard woods for heavy-duty pallets are beech, birch, hickory, maple, cherry, ash, oak or tupelo gum. Three 2 in. x 4-in. stringers, or runners, are needed for each pallet, and the face boards should be 1-in. commercial stock from 4 to 8 in. wide with the end boards 6 in. wide.

Cement-coated, drive screw nails are satisfactory as fasteners, but all nail holes should be drilled with the proper size of bit to prevent splitting of the boards when they are nailed together.

Advantages of Pallets

The principal advantage of pallets, as well as skids, is their adaption to unit loads, that is, loads combined into one unit and moved without breaking bulk. The larger such a unit load may be and the greater the number of moves that must be made, the more economical will be the handling as a unit load. Thus, while a hand truck may handle a 1,000-lb. load, power trucks can handle unit loads up to 5 ton. Furthermore, if a company can receive material, such as castings or forgings for example,

on pallets, do all handling by fork truck and so reduce manual handling in receiving and distributing, and ship the finished products on pallets, maximum economy will be effected.

Although unit loads are applicable to both pallets and skids, the former occupy less space, distribute the weight of the load more evenly when tiered, add less than 4 in. to the height of each tier as compared to from 7 to 12 in. for skids, and cost considerably less.

Assembling Unit Loads

In palletizing the handling system, it is highly desirable to standardize a method of assembling unit loads on pallets. Products either regular or irregular in shape can be palletized by tabulating the sizes and working out an arrangement to utilize the entire area of the pallet. If necessary, a blank space may be left at the center or an overhang of 4 to 5 in. may be allowed if the parts or packages are not fragile. Careful packing is necessary for stable loads and alternate rows may be interlocked to increase stability by placing heavy paper or fiber board between the horizontal rows of packages or by alternating the patterns to avoid columns within the load. The height of stacking on pallets depends on the strength of packages, capacity of trucks, and floor-load capacity and headroom in the warehouse. Items such as pipe fittings or those that cannot stand stacking pressure can be handled in crates, collars or bins mounted on pallets.

As standard containers usually have dimensions of 12, 18 or 24 in., a satisfactory size of pallet is 48 by 48 in., although other sizes are in use. When containers are of unusual size or shape, it may be advisable to modify them for palletizing, or the pallet loads may be assembled in model form first because so doing saves time and encourages the trial of new ideas.

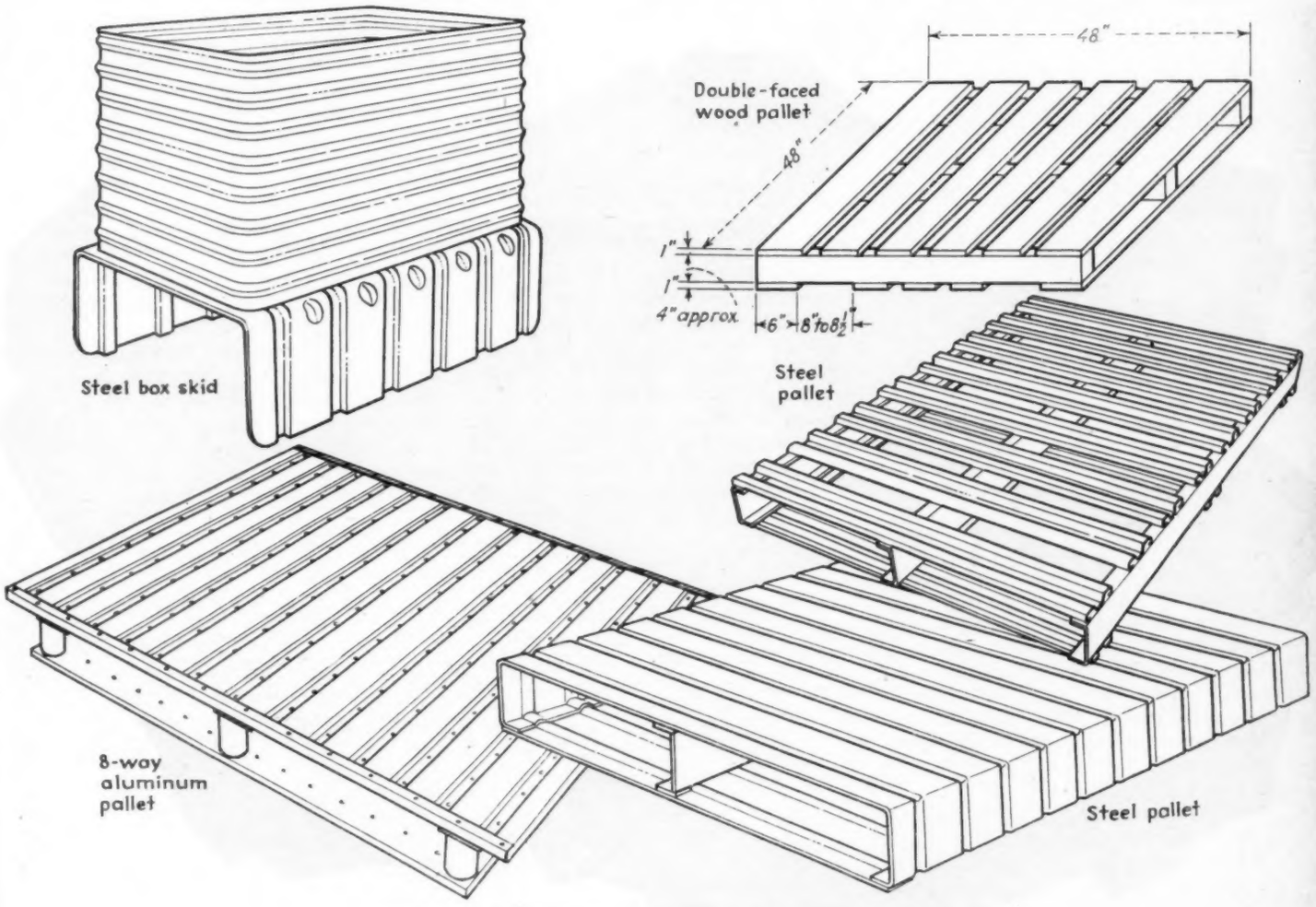
Strapping Loads

When unit loads have been assembled, it is generally necessary to strap them for safe shipment. Not only does strapping reinforce the containers, but it reduces shipping costs by permitting the use of lighter, less expensive containers and speeds up handling by making shipping by pallet practical, safe and economical.

In applying steel strapping, either nailed or nailless, certain precautions should be observed. Straps should be absolutely horizontal or vertical to avoid slack, except when the position of a pallet stringer requires a slight deviation. Only after a strap has been positioned correctly should it be tightened and then only enough to cause it to bite slightly into the edges of the boxes and pallets. With nailless strapping, which has the two strap ends joined by a metal seal, it is advisable to have the seal on the side of the load to preserve an even bearing surface on the top and to cut off loose ends of straps to avoid possible injury to workers.

Similar packaging may be done on skids, or battens may be nailed or strapped to the bottom of unit loads to permit handling by lift or fork trucks.

A new method of securing pallet-



VARIETY OF WOOD, STEEL AND ALUMINUM SKIDS AND PALLETS

PALLET RACKS FOR STACKING OF UNEVEN LOADS

ized or unitized loads of corrugated, solid fiber or wooden shipping cases uses glue instead of steel strapping. The most efficient device for applying the glue to corrugated and solid fiber containers consists of an adjustable pair of friction-driven solid or serrated wheels revolving in a glue reservoir. The wheels are mounted at the delivery end of a wheel conveyor, either at the end of the production line or at the loading platform.

As the containers pass over the gluing wheels, a thin glue film, either continuous or intermittent, is applied to the bottom of each container in lengthwise strips. When the containers are then palletized, the glue provides sufficient strength to hold the containers firmly together. As wooden cases generally have rough, uneven surfaces, they are palletized with glue by inserting between the layers strips of chipboard dipped in a glue bath.

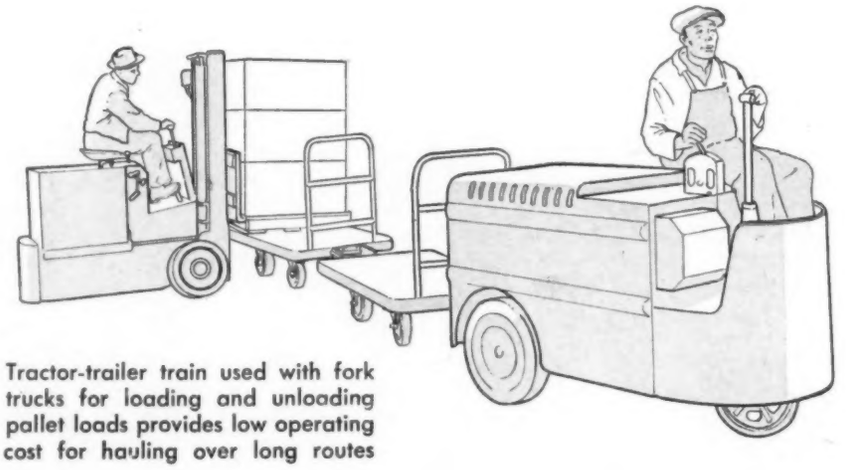
A glue containing a special filler is now being developed to permit direct brush application. The filler is added to level the uneven wood surfaces sufficiently to provide ample area for adhesion. If successful, this method will probably supplant strip gluing.

TRACTORS AND TRAILERS

The tractor-trailer system is considered the most efficient for hauling materials because the motive unit is separate from the carriers, permitting pulling instead of carrying and greater utilization of the tractor. The system is flexible in that the train is not confined to any fixed path but may be routed and systematized to tie into production schedules. As the loads are always on wheels, they may be moved short distances by hand, such as between operations or to train assembly points. In effect, a tractor-trailer train when assembled becomes a conveyor, yet unlike a fixed conveyor it may be broken into its components to spot single trailers where required or to divert them off regular routes for pick-up or delivery and it may quickly be adapted to changes in production.

Industrial tractors are available either as battery-electric or gas-mechanical and are mounted on either three or four wheels. Three-wheel tractors are compact, have short turning radii and are suitable for use in congested areas in factories, whereas the larger four-wheel trucks require considerably more working space but have greater draw-bar pull and can be operated at greater speeds over fairly rough surfaces. Maximum draw-bar pulls range from 2,000 to 6,000 lb., the latter being sufficient to tow a trailing load of 150 tons. Selection of the type of drive, battery or gas engine, depends on the same considerations as for lift and fork trucks.

Trailers can be adapted to the materials to be moved: standard platform trailers for general service, dump bodies for bulk materials, box bodies for small parts and dollies for barrels and objects too heavy for platform trailers. Generally, trailers are of the caster, four-wheel or fifth-wheel steer types. The caster trailer has good trailing qualities and can be maneuvered close to walls or piles of material. The latter two types also have good trailing qualities and are employed generally for handling extremely heavy loads, for long hauls and for general yard work. On the caster-type of trailer, self-couplers make it possible to couple trailers automatically and more safely than with hand-operated couplers.



Tractor-trailer train used with fork trucks for loading and unloading pallet loads provides low operating cost for hauling over long routes

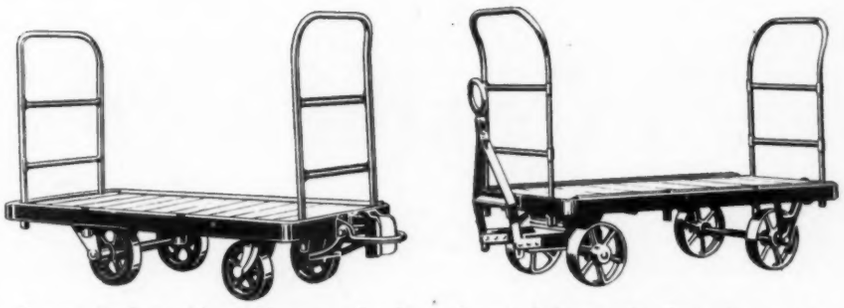
INDUSTRIAL TRUCK MAINTENANCE

Adequate maintenance of industrial trucks pay dividends in longer truck life, overall lower operating costs and elimination of breakdowns that might interfere with production. The following suggestions are listed to provide a foundation on which a mantenance program may be based:

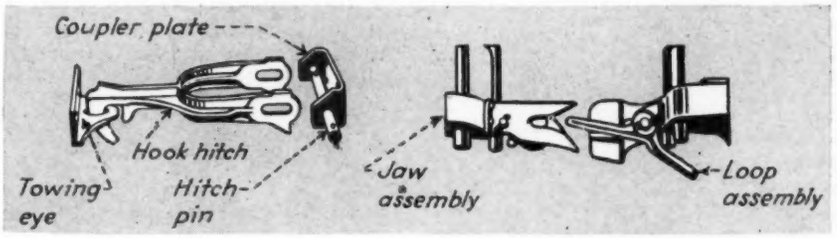
1. Provide good floor conditions. Floors should be clean, smooth, hard and level to reduce tractive resistance and tire wear, and ramps should be gradual—not over 10% grade.
2. Do not permit overloading.
3. Lubricate and check batteries at regular intervals.
4. Keep a log sheet on each truck, showing inspection reports, lubrications, repairs and all adjustments, and down time for repairs.
5. Make weekly inspections of brakes, tires, steering connections, wheel alignment and hoisting mechanism.
6. Make monthly inspections of axles, universal joints, wheel bearings, spindle bearings, brake drums, motors, brushes, controller, contactor, limit switches and hydraulic cylinder.

Maintenance of battery trucks includes the daily charging of batteries, which requires from 6 to 8 hrs. If the trucks are operated for only one shift, the batteries can be charged without removing them by installing outlets in the charging room where the trucks are parked. If the trucks need spare batteries changed at intervals, the charging room is laid out for batteries only. Changing of the batteries can be accomplished by using roller-top tables mounted on casters to carry the batteries, hoists suspended from monorail arranged as jib or traveling cranes, or benches of the same height as the compartment skids.

Batteries may be charged with direct or rectified alternating current. Direct current may be employed with suitable control equipment or motor-generator sets. Multiple-circuit units utilizing alternating current and a constant voltage generator charge a number of batteries at once. By use of an ampere-hour meter each battery can be automatically disconnected from the circuit when fully charged and the motor-generator set can be automatically shut off when the last battery has been disconnected.



Caster trailer with rigid rear wheels and swivel front wheels is for general use. Fifth-wheel steer trailer is used for heavier loads and rough roads



Hand-operated and self-couplers for caster trailer. Self-couplers provide automatic coupling and speed up movement of materials

We Acknowledge

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Allis-Chalmers Mfg. Co.
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American Hoist & Derrick Co.
American Monorail Co.
Atlas Car & Mfg. Co.
Baker-Raulang Co.
Barrett-Cravens Co.
Bucyrus-Erie Co.
Chisholm-Moore Hoist Corp.
Clark Equipment Co.
Cleveland Crane & Eng. Co.
Cleveland Tractor Co.
Coffing Hoist Co.
Conco Eng. Works
Crescent Truck Co.
Curtis Pneumatic Mach. Co.
Detroit Hoist & Mach. Co.
Easton Car & Const. Co.
Economy Eng. Co.
Electric Industrial Truck Association
Electric Storage Battery Co.
Electro Lift, Inc.
Elwell-Parker Electric Co.
Euclid Crane & Hoist Co.
Fairbanks Co.
Farquhar, A. B., Co.
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Truscon Steel Co.
Union Metal & Mfg. Co.
Westinghouse Elec. & Mfg. Corp.
Whiting Corp.
Wright-Hibbard Elec. Ind. Truck Co.
Yale & Towne Mfg. Co.

SELECTION OF HANDLING SYSTEM

MATERIALS HANDLING is so important an operation that the handling system should be laid out when the factory building is planned or the building itself should be planned around the handling system. In most cases, however, installations of handling systems are made in existing buildings in an effort to reduce costs or to solve handling problems arising from changes in manufacturing practices.

When such rearrangements are necessary in the production line, the materials-handling system should be selected from the results of an analytical study rather than more or less by guess. Seldom can the handling problems of a plant be solved by use of any one type of equipment, as most frequently a combination of types provides the most effective system. Some types may be selected because they are the only ones capable of doing the work, but when there is a choice, selection should be based on the comparative cost per ton of material handled *efficiently*. Cheap handling may mean best handling, or it may mean production bottlenecks, sloppy housekeeping, high accident rate and dissatisfied personnel.

Plan Your System

Solution of a handling problem should begin with the layout of the plant so far as placement of departments in relation to each other and the arrangement of production equipment within each department are concerned. Production layouts should be made so that handling of materials or parts is reduced to the bare minimum. Such planning is facilitated by use of flow diagrams, charts in scale and three-dimensional models by which the whole problem may be studied and changes made to determine the best sequence of operations, reduce travel distances to a minimum and coordinate the flow of parts and subassemblies.

Planning of a handling system may be systematized by determining the following factors for each of the routes over which material moves through receiving, stores, successive points of manufacture, stock and shipping:

1. Kind and nature of material—which may indicate type of equipment, depending on whether units, containers or bulk is to be moved and what care must be taken in handling.
2. Tonnage—from which ton feet per route may be computed.
3. Weights, dimensions and uniformity of unit loads.
4. Direction, length and nature of movement—which includes cross traffic, any possible variation in route and whether route lies in one or more bays or buildings.
5. Time per trip.
6. Variation in rate of flow of materials.
7. Effect of system on pacing and coordinating production.
8. Handling cost—based on labor, power, repair and maintenance, depreciation, interest on investment, insurance, taxes, accidents and compensation rates, breakage of products, cost of taking inventories, value of floor space and building maintenance.

From a study of these factors, the materials-handling engineer may select a conveyor system if unit loads are uniform, if the material moves or can advantageously move continuously, if unit loads, rate of movement and location of route are not likely to vary and if there is no cross traffic. But for intermittent moves of large units limited to one bay or building, regardless of cross traffic or uniformity of loads and rates, he would consider an overhead traveling crane. Likewise, he would consider an industrial truck system for intermittent moves regardless of bay or building limits, uniformity of loads and rates, or cross traffic.

It is evident that the foregoing factors are influenced by the nature of the industry and the kind of manufacturing processes. Thus, for assembly lines of any size unit, from a small electrical part to an automobile, —in fact, for serving related or unrelated sequences of manufacturing processes planned so that all processes in the sequence are performed at the same rate, conveyors offer the practical method. Conveyors too are the logical choice in departments that perform the same kind of work and in which unit loads remain uniform. But for the jobbing shop, where unit loads and operations vary widely, overhead traveling cranes or industrial trucks are more practical equipment.

Hoist Selection

A simple, but typical, handling problem often occurs where it is necessary to lift and move loads over a limited area, such as around a machine or over a processing tank. The logical equipment would be a hoist supported on a traveling or jib crane, but here too selection of hoist must be made because each type, if properly applied, is most economical for its particular application. A means of determining the handling cost is by use of the Hoist Selection Graph, which affords cost comparison between electric and chain hoists. In

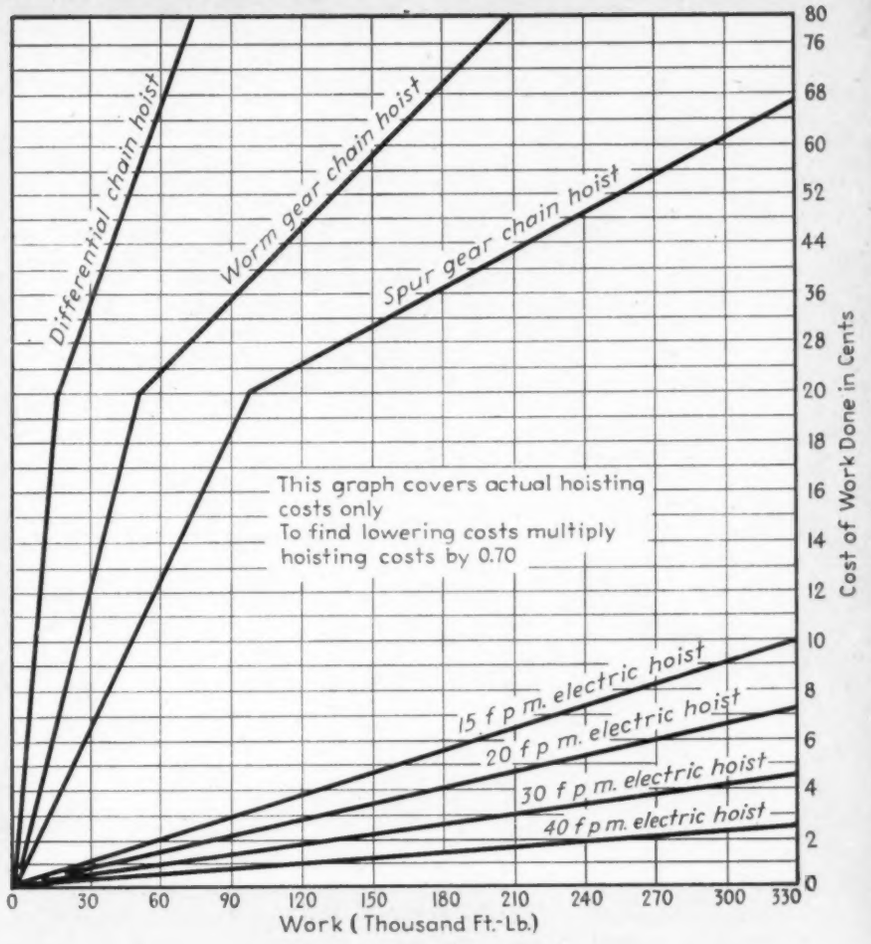
AVERAGE RANGE OF CRANE SPEEDS — FEET PER MINUTE

CAPACITY IN TONS	HOIST			TROLLEY TRAVEL			BRIDGE TRAVEL		
	SLOW	AVERAGE	FAST	SLOW	AVERAGE	FAST	SLOW	AVERAGE	FAST
3	26	50	90	100	125	200	160	300	400
5	26	40	80	100	125	200	160	300	400
7½	20	38	75	100	125	200	160	300	400
10	20	30	60	100	125	200	160	300	400
15	18	26	45	100	125	200	160	300	400
20	15	26	39	50	100	150	160	300	400
25	15	20	30	50	100	150	160	300	350
30	10	15	26	50	100	150	140	225	300
40	6	8	16	40	80	100	100	200	275
50	6	8	13	40	80	100	100	150	275
60	5	8	10	40	80	100	75	150	250
75	4	7	10	30	60	100	50	100	250
100	4	6	6	25	60	100	50	100	225
125	3	6	6	25	50	75	40	100	225

the lower limits of the graph, there is a point where the savings do not warrant the initial expense of an electric hoist.

It can, however, be assumed that an electric hoist is justified when the savings in 5 yr. are greater than the difference in cost between the two hoists. For example, for an operation such as lifting automobile engines weighing 750 lb. at the rate of seventy-five per hour with a 4-ft. lift, the work done per hour would be 750x75x4 or 225,000 ft-lb. From the graph, it can be found that the cost of doing this work is 1.7 cents with a 40 fpm. electric hoist and 46 cents with a spur-gear chain hoist. If 250 eight-hour days are worked each year, the difference in cost would be (46-1.7)x250x8 or $886 per year.

Purchase of an electric hoist would be well justified. The costs as here calculated disregard overhead, labor is computed at 50 cents per hour and the current is figured at 2 cents per kilowatt-hour. As the graph represents average conditions only, each individual problem should be analyzed to determine if the conditions are comparable.


Differential chain hoist
Worm gear chain hoist
Spur gear chain hoist
This graph covers actual hoisting costs only
To find lowering costs multiply hoisting costs by 0.70
15 f p m. electric hoist
20 f p m. electric hoist
30 f p m. electric hoist
40 f p m. electric hoist
0 30 60 90 120 150 180 210 240 270 300 330
Work (Thousand Ft.-Lb.)
0 2 4 6 8 10 12 14 16 18 20 28 36 44 52 60 68 76 80
Cost of Work Done in Cents

HOISTING COSTS COMPARED

Hoist Selection Graph affords cost comparison between electric and chain hoists

Crane Selection

If such a handling job had to cover a greater area, however, an electric traveling crane would be the logical choice. Purchase of an electric traveling crane represents a major expenditure and therefore requires the greatest care in selection. As service requirements vary so much, it is possible to make mistakes in selection that will seriously interfere with production and increase handling costs. Therefore, it is advisable to consult with the engineers of crane manufacturers.

One manufacturer of electric traveling cranes divides crane service into five duty classifications:

1. Steel mill—where cranes are built to customer's specifications, with special emphasis on ruggedness and fast speeds.

2. Continuous material handling—where cranes are intended for handling bulk material.

3. Regular industrial—where cranes are used in service which, while not continuous, involves enough loads of various sizes to justify employment of a full-time operator. Such a crane is in more or less constant use handling small loads, holding work being set up in machine tools, and often transporting loads 50% greater than its rated capacity.

4. Intermittent industrial — where cranes are not in constant use and require no full-time operator, as in warehouses and assembly floors. In such service, the cranes may be slower but should be of equal capacity to those intended for continuous service.

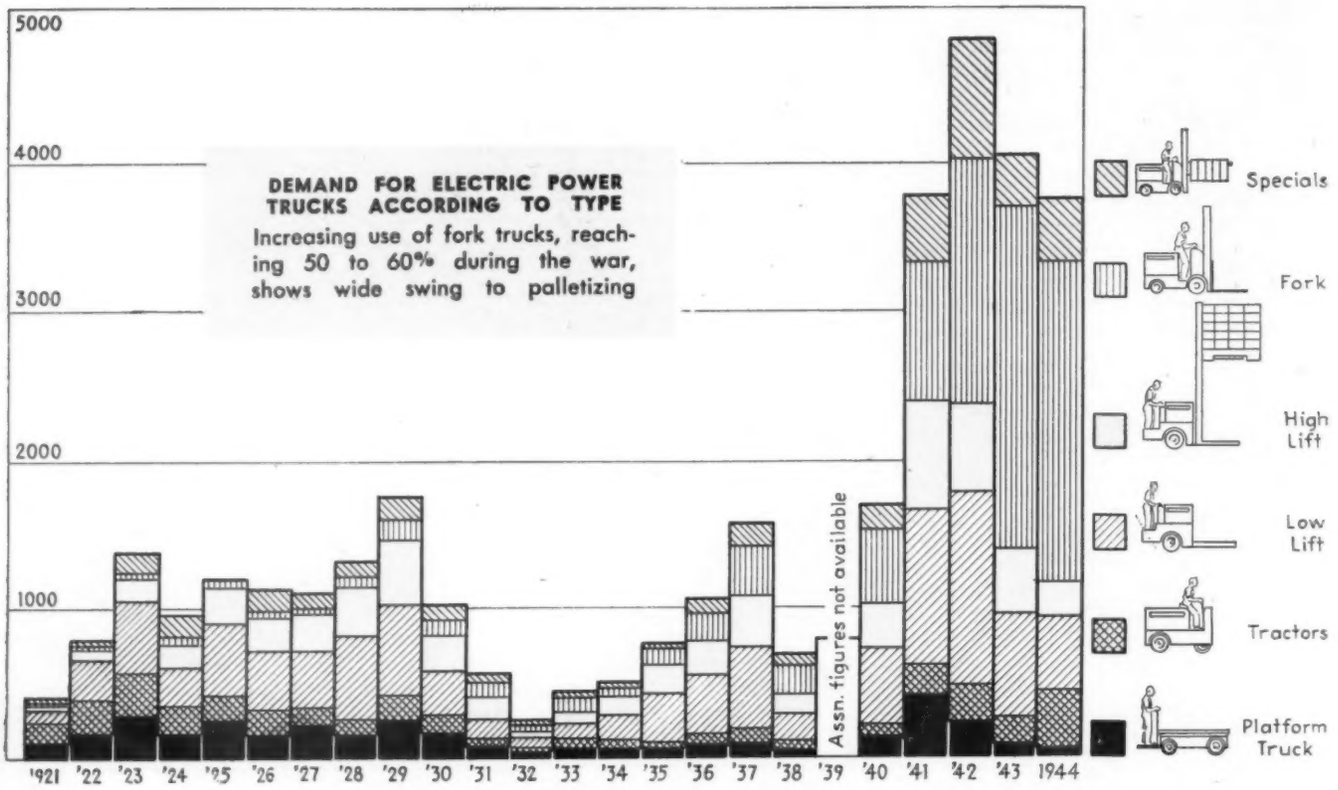
5. Standby service—where cranes are needed only to service machinery and are not often used. As such cranes operate at slow speeds and are seldom overloaded, they can be built cheaper than those used more often and for a wider variety of work where overloads are more common.

To determine the size of crane to purchase, it is safe to assume that the capacity should be equal to the average load and not less than 80% of the maximum load. If many of the frequently handled loads are small compared to the maximum load, an auxiliary hoist of higher speed and lower capacity, mounted either on the same trolley or on a separate trolley, may be desirable.

Standard cranes are usually rated as ½, 1, 2, 3, 5, 7½, 10, 15, 20 and on up to 250 tons, with auxiliary hoists ranging from 3 to 25 tons. Dimensions of the crane are determined by the dimensions of existing buildings. It is economical, however, to design new buildings, in accordance with standard crane dimensions, thereby realizing a saving in the initial cost of the crane.

The service requirements also govern the speeds of the hoist, trolley and bridge. A heavy-duty crane should necessarily operate at a slower speed than a crane of light capacity. Steel-mill service or bulk handling requires fast speeds, regular industrial service medium speeds, and intermittent industrial or standby service slow speeds. With the capacity and class of service determined, the proper speeds of hoist, trolley and bridge may be selected from a crane speed table.

The selection of motors depends on the speeds and class of service. Slower speeds mean smaller motors, lower first cost and lower power consumption. For regular industrial service, motors should be specified that will run continuously for 30 min. with a tem-


5000
4000
3000
2000
1000
DEMAND FOR ELECTRIC POWER TRUCKS ACCORDING TO TYPE
Increasing use of fork trucks, reaching 50 to 60% during the war, shows wide swing to palletizing
Assn. figures not available
'21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 1944
Specials
Fork
High Lift
Low Lift
Tractors
Platform Truck

perature rise not exceeding 55° C., but for intermittent or standby service, motors with a 15-min. rating are adequate. The type of motor may also vary from a slip-ring induction motor for variable speed control to a squirrel-cage induction motor for constant speed control. With direct current, the motor is usually series wound with resistors in the motor circuit. Cranes to operate at extremely slow speeds may even require the use of gear motors, which are available for either direct or alternating current.

If study of the required handling operations shows that an industrial truck system is best adapted, it is then necessary to determine which truck system will have the fewer lost motions, require the least manual handling, meet all handling requirements and afford the least cost per unit of material handled. The size of unit load automatically determines the load-carrying capacity, but determination of type and number of trucks can be made only on the basis of hauling distances, tons per trip, trips per shift, and number and height of tiering operations.

Where tiering and carloading are factors, the fork-truck-pallet system is generally selected because pallets, in such work, are preferable to skids. For other hauls where loads are heavy and no tiering is required, lowlift trucks may be selected and integrated into the pallet system by handling the pallets on skids. But where hauls are made over long distances, 500 ft. or more, a still more efficient system may be organized by use of tractor-trailer trains for the distance hauling.

Their integration into the system can readily be made by using fork- or lift-trucks to set pallet or skid loads on the trailers. Loading and unloading in this manner reduces terminal time of the tractor. For shorter distances the trucks themselves may serve as tractors, both carrying a load and pulling loaded trailers.

The number of trucks can be determined from the number of trips and distances. For example, if 2,000 two-ton skid loads are to be moved 100 ft. in an 8-hr. shift, a 2-ton lowlift truck would be selected. Assuming speeds of 400 fpm. loaded and 500 fpm. light, pickup time of 4 sec. and release time of 3 sec., a round trip would require: pickup—4 sec., carry load—15 sec., release—3 sec., return—12 sec., totaling 34 sec. It is necessary, however, to include a delay factor to compensate for acceleration, maneuvering and other delays. Usually the delay factor is greater for short trips, averaging, according to the Electric Industrial Truck Association, 2.5 for 50-ft. routes, 2.0 for 100 ft., 1.5 for 250 ft. and 1.2 for 500 ft. Thus, the foregoing round trip would require 34x2 or 68 sec. On this basis, one truck can make 53 trips per hour and 424 trips per 8 hr. shift. To handle 2,000 loads, five trucks would be needed.

To determine whether it is economical to install power trucks in place of hand trucks, an operating cost summary is made, including depreciation, maintenance, battery charging and insurance costs. Thus, for a truck costing $2,000, battery $420 and charger $750, a typical estimate is shown in the table below.

ESTIMATED YEARLY TRUCK COSTS

Annual tire cost	$100.
Truck depreciation: 6 1/2% ($2,000-$100)	123.50
Battery depreciation: 16 1/2% of $420	70.
Charger depreciation: 5% of $750	37.50
Truck maintenance	90.
Battery maintenance	30.
Charger maintenance	10.
Charging current	45.
Insurance	14.
Total per year	$520.00
Total per day (260 days per year)	2.00

The operating cost of $2.00 per day does not include depreciation and maintenance of skids or interest on investment, as the example is intentionally condensed. It is, however, a typical figure, because operating conditions cause costs to vary and depreciation and maintenance costs also vary according to types of equipment. The life of a lead battery, for instance, may be only 5 yrs., whereas an alkaline battery may last 8 yrs. Furthermore, depreciation on an electric truck may be estimated anywhere from 5 to 8½%. Average costs and depreciations have been assumed. In fact, at least one company figures depreciation, maintenance and charging at a flat cost of $1.25 per day.

If it is conservatively assumed that the operating cost per day remains at $2.00, no matter how many hours the truck is operated, and the operator's wage is $1.00 per hour, the costs of operation would be as shown at the right.

ESTIMATED TRUCK OPERATING COSTS

Hrs./Day	Total Trips	Tons	Truck Cost	Wages	Total Cost	Cost/Ton
8	424	848	$2.00	$8.00	$10.00	$0.0118
4	212	424	2.00	4.00	6.00	0.0141
1	53	106	2.00	1.00	3.00	0.0283
½	26	52	2.00	.50	2.50	0.048
¼	13	26	2.00	.25	2.25	0.0866
⅛	6	12	2.00	.13	2.13	0.1775

If by hand-trucking, a man can move 400 lb. per trip and make 20 trips per hr., handling costs at an assumed cost of $0.65 per hr. would be $0.1625 per ton. Therefore, if each truck is used more than ⅛ hr. per day, a definite saving is effected. However, five trucks to handle 4,000 tons per day would each handle 800 tons at a cost of $0.0125 per ton. The saving per year in handling 2,000 two-ton loads per day by five power trucks would be $(0.1625\text{-}0.0125) \times 4{,}000 \times 260 = \$156{,}000$. Even this great saving has been exceeded in actual cases as hand trucking on large volumes causes such congestion that movement is slowed down and costs rise far above those assumed.

Selection of other types of trucks and tractors can be made by similar analyses. In fact, if the length of movement were greater in the preceding example, an analysis might show the most economical method to be a lift truck used as a tractor or a tractor-trailer train with lift trucks for loading and unloading at terminal points.

Such studies require, no matter what the equipment may be, data that is not generally available. It is, therefore, suggested that, in analyzing any handling problem and selecting the proper equipment, engineers of equipment manufacturers be consulted, because they are specialists in the application of their particular types of equipment. They can offer constructive ideas and data on comparative costs developed through experience with similar problems. They can supply, not only equipment, but solutions to materials-handling problems.

SAFETY IN HANDLING

THE NATIONAL Safety Council, Inc. estimates that from one quarter to one third of all industrial accidents occur in handling materials. While the introduction of mechanical equipment has greatly reduced the number of accidents, new hazards are presented that increase their severity. Even now, the greater number of accidents happen to workers handling materials by hand, yet by far the most serious occur in improper use of the mechanical equipment.

The seriousness of manual-handling accidents and their effect on industry are shown by reports from the U. S. Department of Labor to the effect that back strains result in an average time loss of 19 wks., the average length of disability for all strains is 7.2 wks., and hernia generally lays up a worker for 8 wks.

These facts and many like them have made industrial companies stop —and think of safety. Many have studied the materials-handling problem carefully and thoroughly in an attempt to promote safety by standardizing methods of handling. The recommendations and hints in the discussion on the following two pages, based on safe practices suggested by the National Safety Council, will bear investigation in such a study.

SAFETY—RESPONSIBILITY OF MANAGEMENT

The elimination of hazardous conditions is the direct responsibility of management. As a primary basis of attack on the problem, it is suggested that the following steps be taken:

1. Select physically qualified workers for manual-handling jobs.
2. Train workers in the correct methods of lifting and carrying and in the proper use of the equipment.
3. Institute constant supervision to insure that correct methods are being followed.
4. Analyze handling problems from a viewpoint of safety as well as cost to determine how materials should be handled.
5. Install mechanical equipment where practicable and where analysis shows its need. Hoist, crane, conveyor, industrial truck—any one of these, when used safely, will cut the time and money wasted from avoidable accidents.

Safety Suggestions

MANUAL HANDLING

1. Handling long material is dangerous at its best. If handled by one man, the load front should be kept high to prevent possible injury to approaching persons.

2. Move heavy, flat objects by crane or truck, not by carrying or rolling by hand.

3. Handle objects on inclines by rope or tackle.

4. Pile carefully. Pile barrels and kegs on end and stabilize by laying plank on each row. A triangular pile is safest for barrels. In piling boxes, crosstie when possible; otherwise, pile on the side having the greatest area. Never pile materials to interfere with sprinklers, fire hose, valves, lighting and exits.

5. Move heavy, bulky articles on rollers when they must be handled by hand. Keep hands from under rollers.

6. Keep tote boxes in good condition.

7. Use of racks for odd shaped articles saves time and eliminates much handling by hand.

8. Teach your workers to lift by bending at the knees and using the leg muscles, instead of bending at the waist. Also, taking a deep breath and holding it until the weight is in carrying position will help by tensing the muscles and making them less liable to injury.

9. Insist that all workers wear some kind of hand protection when handling rough materials. Some workers prefer hand leathers, and others gloves.

10. Encourage the wearing of safety shoes by anyone in danger of injury to feet from falling objects.

HOISTS AND CRANES

1. Definite signals for lifting, lowering or transporting a load, or for any movement of hoist or crane, should be adopted and rigidly followed.

2. Side pulls by hoists are dangerous. Avoid by placing the hoist directly over the load.

3. Inspect hoist and crane hooks regularly for possible cracks, wear, bending and other faults.

4. Inspect the cable at regular intervals.

5. Lubricate the chains and sheaves as often as required by the atmospheric conditions.

6. Have the hoist control ropes marked plainly by name or by an arrow designating the direction of movement.

7. Use a clevis when attaching an air hoist to a trolley to prevent possible unhooking should the piston rod come in contact with an obstruction when lowering.

8. Avoid side pulls by cranes.

9. Ground electric portable cranes to prevent shock in case of short circuit.

10. Post capacity charts in tractor and locomotive cranes to prevent tipping.

11. Never let any person stand or pass under a loaded electromagnet.

12. Let no one, except authorized personnel, operate an overhead crane or act as hooker.

13. Insist that all workers pay attention to warning signals and get out from under loads carried overhead.

14. Prohibit riding on crane hooks, except for inspection and repair work.

15. Avoid overloading of chains and slings.

16. Equip all hoists and cranes with limit stops to prevent raising the load too far and breaking the cable.

17. Use a cable long enough that two full wraps will remain on the drum when the hook is in its lowest position.

18. Protect bottom sheaves with close-fitting guards to prevent the cable from becoming misplaced and workers hands from being caught in the sheave.

19. Prohibit the workers from placing their hands on loaded cables, slings or chains.

20. Crane operators should inspect daily all the working parts of their cranes.

21. Limit switches should be tested at the beginning and end of each shift.

22. Never let the operator depend on the limit switch to stop the load. Control should always be from the cab.

23. In an emergency when the brake fails, the load can be held with the current.

24. If the crane is equipped with dynamic braking, throwing the controller to zero will give the brake a chance to stop the load.

25. Prohibit the operator from ever leaving a hanging load. Whenever he leaves the cab, the load should be lowered to the ground.

26. Eating or lying down in the cab should be prohibited.

27. Whenever a side pull must be made by a crane, a snatch block should be used to get a vertical pull.

28. When two cranes are operated in the same bay, they should be kept at least 30 ft. apart. If they must operate closer, care should be taken to prevent their bumping.

29. When two cranes are lifting one load, the operators should take signals from only one floorman.

30. The floorman making the hitch should always make certain that the cables, chains or slings are properly applied to the load and secured to the hoisting mechanism, that the load is free to lift and that all workers are clear.

CONVEYORS

1. Make no repairs or adjustments while a conveyor is in motion. Shut the power off.

2. Long conveyors should have gongs, whistles or some warning device to be sounded before they are set in motion. A push-button station in each room through which a conveyor passes can be hooked into the circuit to prevent starting until all such buttons are pushed.

3. Enclose dangerous parts of power-driven conveyors by guards.

4. Prohibit any riding on conveyors, unless the conveyor is specifically adapted for it.

5. When a conveyor is loaded by hand, its speed should be set to give the worker ample time to place the material properly.

6. To avoid accidents to workers' hands at the delivery end of spiral chutes, install a warning device to show when a package is to be delivered.

7. Insist that articles be placed on conveyors carefully to avoid their pulling off and striking anyone.

8. Never permit cleaning of belts or drums of belt conveyors while they are in motion.

9. Keep belt tension less than the maximum rating.

10. When railroad cars are being unloaded or unloaded by portable conveyors, take the utmost care that the car is not shifted.

11. Moving conveyors can be dangerous. Prohibit the workers from crossing them except at cross-overs, such as bridges or tunnels.

12. When conveyors pass over aisles or workers, guards should be installed to catch any objects that may fall off the conveyors.

13. Install conveniently located devices for stopping conveyors in case of accidents.

14. Institute periodic inspections to keep all conveying machinery in proper working condition.

15. In spite of all types of safeguards, accidents on conveyors will occur if the workers are not instructed in the correct methods of operation and acquainted with the possible hazards.

16. Gravity conveyors may be blocked by overloading and from other causes. Never let an inexperienced man release the blockade.

17. Open spiral chutes form a chimney from floor to floor, and may cause a fire to spread rapidly. This condition can be prevented by enclosing the chute or by providing automatic fire doors where the chutes pass through the floors.

18. If objects falling from a roller conveyor can endanger any workers, guard rails should be povided at such points.

19. On chain conveyors, always guard the chain against any contact with the workers.

20. When materials are placed on an overhead trolley conveyor by hand, the workers should exercise care not to get hands caught on the carriers or to drop objects on their feet.

INDUSTRIAL TRUCKS

1. Bad floor conditions cause accidents and delay traffic. Even small holes may cause a truck to swerve and spill its load or to upset. Build floors to withstand the traffic and then keep them in repair.

2. Check the floor loading before installing and using power trucks or tractors.

3. Insist on clear aisles, plainly marked for pedestrian and truck traffic.

4. Reduce congestion by one-way traffic in narrow aisles. Aisles should be at least 2 ft. wider than the widest load for one-way traffic and at least 3 ft. wider than twice the width of the widest load for two-way traffic.

5. Avoid short, steep, narrow ramps. The grade should be not over 10% for efficient operation.

6. Erect stop signs or traffic signals at dangerous intersections.

7. Insist on power-truck operators' observing a safe speed limit.

8. Top-heavy loads are dangerous. Load skids, pallets, trucks and trailers carefully to avoid spills. Use side stakes or racks when needed to hold loads in place.

9. Training of truck operators pays dividends in accident reduction, lower maintenance, faster handling.

10. Allow only qualified operators to drive trucks, and prohibit passengers.

11. Establish and enforce operating rules.

12. Schedule regular maintenance inspections.

13. Install automatic couplers on trailers.

14. Never allow workers to leave hand trucks or trailers with their long tongues extending into aisles.

15. Guard against possible atmosphere contamination by gasoline-driven trucks and tractors in indoor operation.

16. Insist on operators' sounding gongs or horns when approaching tunnels, doorways or blind corners.

17. Standardize on the warning device so that it can readily be recognized. It should have a distinctive sound different from other gongs or horns used in the plant.

18. Accidents can be reduced by standardizing the controls for starting, shifting, braking, steering, etc. Brakes and steering controls, for example, vary widely from one make of truck to another.

19. If controls are not standardized, assign each operator to a specific truck or train each operator in the use of any type he may be called on to operate.

20. Forbid overloading either in weight or in height so that the operators' view may not be obstructed.

21. Never move a load on the wrong type of truck.

22. Prohibit high-lift or fork trucks from being driven with the load elevated. Fork-truck loads should be cradled in transit by the tilting mechanism.

23. Hand accidents can occur if guards are not provided to prevent hands and fingers from getting caught between the steering handle and columns, walls and other objects.

24. Organization of a traffic department to control all movement of trucks as well as materials has many advantages. Not the least of them is the reduction in accidents resulting from the systematic regulation of plant traffic.

25. To promote safety as well as efficient maintenance, dispatching and control of equipment, trucks should not be left standing in aisles, corners or other such places. Provide suitable storage space, centralized if possible.

DOES YOUR PLANT NEED A MATERIALS-HANDLING SURVEY?

Answers to these questions will show you what materials-handling problems exist in your plant. They will suggest possible solutions and, most important of all, will indicate whether you can well initiate a complete materials-handling survey

LABOR

1. Are male workers manually handling materials weighing over 40 to 50 lb.?

2. Are female workers manually handling materials weighing over 25 lb.?

3. Are male workers frequently lifting materials from floor to overhead?

4. Are female workers frequently lifting materials from floor to chest height?

5. Do you have many 2-man lifting jobs?

6. Do your machine operators waste production time handling materials? Over ½ hr. per day?

7. Do your workers handle manually similar materials every day?

8. Is skilled labor ever required to handle materials?

9. Are your lost-time accidents high as a result of present handling methods?

10. Is your indirect labor cost too high?

MOVEMENT OF MATERIALS

1. What materials are moved? Dimensions, weights, physical and chemical characteristics?

2. Do the materials require special precautions because of fragility, inflammability, danger of contamination?

3. Can the materials be tiered in storage?

4. Is there much back-tracking of materials?

5. Can movements be shortened or congestion relieved by different handling methods?

6. Are movements continuous or intermittent?

7. Is cross-traffic necessary with your present system?

8. Are materials handled manually between processing operations?

9. Is production ever tied up, waiting for materials?

10. Does your handling system prevent straight-line production or make it inefficient?

11. Are your materials handled and stored several times before processing?

12. Are your production areas crowded with stored materials?

13. Are your materials ever damaged by exposure to the elements?

14. Are your materials damaged by rough handling?

STORAGE AND SHIPPING

1. Is your receiving department jammed?

2. Is demurrage costing you too much money?

3. Are incoming materials unloaded and stored by manual handling?

4. Are you wasting storage space by not tiering to the ceiling?

5. Have you neglected receiving and shipping in unit loads?

HANDLING EQUIPMENT

1. What materials-handling equipment do you already have? Age and condition?

2. Is the equipment that best adapted for the job?

3. Have you replaced obsolete equipment as rapidly as the resulting gain in efficiency warrants?

4. Is your equipment a makeshift, leftover from previous production jobs?

5. Are your maintenance costs mounting?

6. Is your equipment causing a high accident rate?

7. Is your equipment causing damage to the materials?

8. Have you considered new and improved types of equipment in regards to your handling problems?

• ATOMIZED PARTICLES of sprayed coating attracted to the work in an electrostatic field, give more uniform coverage and reduce overspray and loss, particularly on odd-shaped small pieces

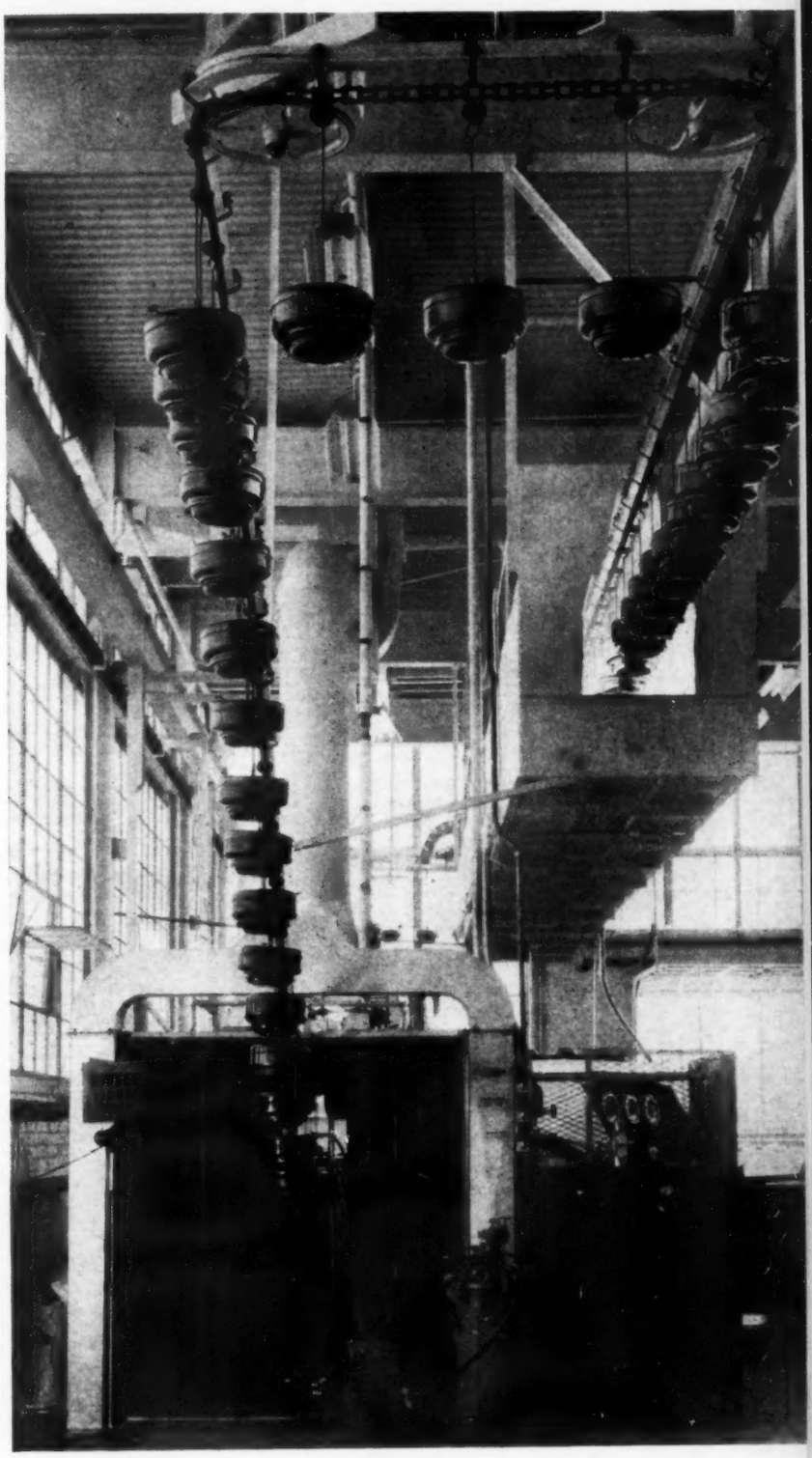
STATIC SAVES SPRAYED PAINT

BY DR. EMERY P. MILLER
HARPER J. RANSBURG COMPANY

EFFICIENCY of spray-finishing opertions can be increased materially by conveying parts through an electrostatically charged field while their surfaces are sprayed with atomized finishing material. High precipitation efficiency is obtained because the finishing material, upon entering the charged zone, becomes charged to the same electrical sign as the electrode system and is therefore repelled from the electrodes and attracted toward the electrically grounded articles being coated.

The electrode system normally consists of frames assembled from ⅜-in. diameter steel rod and suitable tee and angle fittings. Thirty-gage copper wires are stretched across these self-rigid frames at appropriate intervals. In normal practice, a minimum distance of 12 in. is maintained between electrode wires and the surface to be coated. This spacing can be increased to about 18 in. without materially affecting deposition. This permissible variation in spacing makes it possible to pass through the same field objects which do not vary in size more than these limitations indicate.

Where a variety of parts are to be coated, an adjustable electrode system can be provided. In such instances, adjustment is done by hand, as two sizes of items which require such movement cannot be run in sequence unless sufficient conveyor space is allowed to permit this adjustment. Usually an electrode frame is mounted on each side, with the electrodes extending about 4 ft. along the conveyor. On occasion, an electrode frame can be mounted horizontally above or below the part as well if required.



Three spray guns, on an adjustable stand, paint air cleaners. Control for the electrostatic equipment is in the cabinet at right, which also contains guns and auxiliaries. The power-pack for energizing the two electrode assemblies is behind the cabinet. Containers are suspended from conveyor hangers rotated by contact with a belt while passing through the field. Drying is done in an overhead infrared cabinet

The electrostatic field between grounded articles and electrode system is maintained by connecting the electrodes to a suitable voltage source. The voltage pack unit is essentially a high-voltage, low-current source which has a voltage characteristic extremely sensitive to the amount of current drawn from the unit. Because of this characteristic, voltage supplied to the electrode system is essentially a static charge, and very little power is available at the electrode structure.

Pulsating Field

The resulting dc. field pulsates from zero to a maximum once every sixtieth of a second. Maximum voltage reached is approximately 100,000 volts, and the current which passes through the field during normal operation is about 0.4 milliampere. The voltage source which establishes and maintains this field has an overcontrol characteristic which automatically decreases voltage when the current tends to exceed this value. On direct short of the equipment, the maximum current which can be drawn from the power unit is 7 milliamperes. The unit is connected to a 220-volt, single-phase, 60-cycle ac. line capable of delivering 10 amperes.

Current and voltage characteristics of the electrostatic field are maintained constant regardless of the size or shape of the work, type of coating material, or conveyor speed.

Conveyor speed is not limited by the process, but rather is determined by the production volume required and by the time needed at other stations. As far as the spray process is concerned, a change in conveyor speed involves only a change in the amount of material atomized into the charged zone. The lower limit of conveyor speed is determined by the inadequacy of normal spray-gun atomizers to atomize and distribute effectively into the field an exceedingly small amount of finishing material. Installations now in operation have conveyor speeds as low as 3 fpm., others are running at speeds as high as 80 fpm. with equally effective distribution of finishing material.

The entire coating zone is enclosed with a metal booth which serves to isolate the electrode system from other operations and from plant personnel. This booth incorporates an exhaust system to remove solvent vapors and the small amount of coating material which escapes the precipitating action of the field. The exhaust system should move air uniformly through the booth at a speed of about 100 fpm. No personnel danger is involved, because all high-voltage leads and electrodes are completely isolated by the booth and other adequate guards, all of which must be grounded. There is no occasion for the operator to be near any charged part while the equipment is in operation. Even in the event of any accidental contact with charged electrodes or other parts, the shock experienced may be annoying but will not be serious because of low currents.

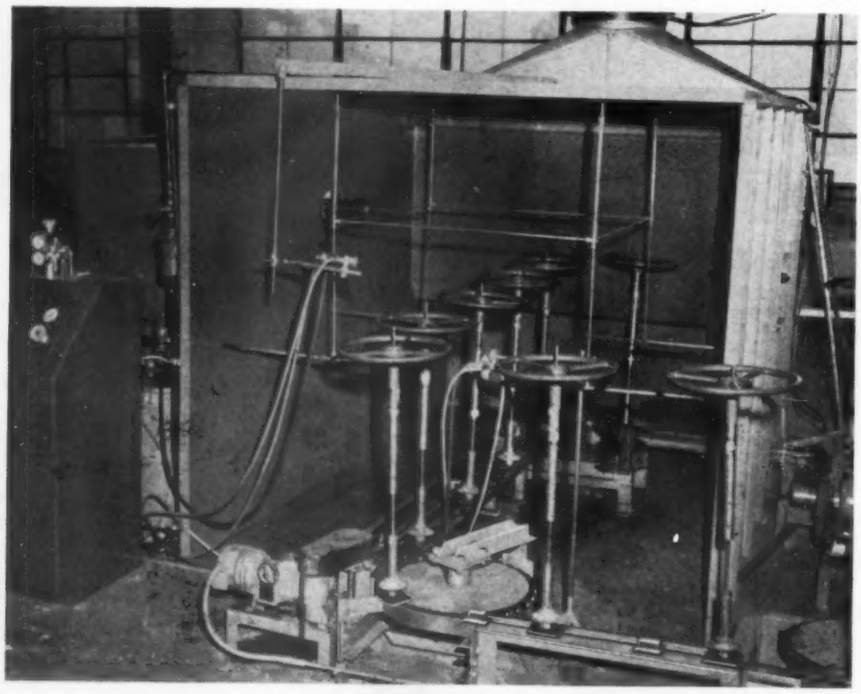
It is essential that the objects to be coated be grounded through the conveyor so the surfaces being finished will be maintained at ground potential. Parts made of non-conductive material must be supported by a metal fixture so the field can be established through the surfaces to be coated. As parts and conveyor are grounded, there is no danger of shock loading and unloading hangers.

Conventional Guns

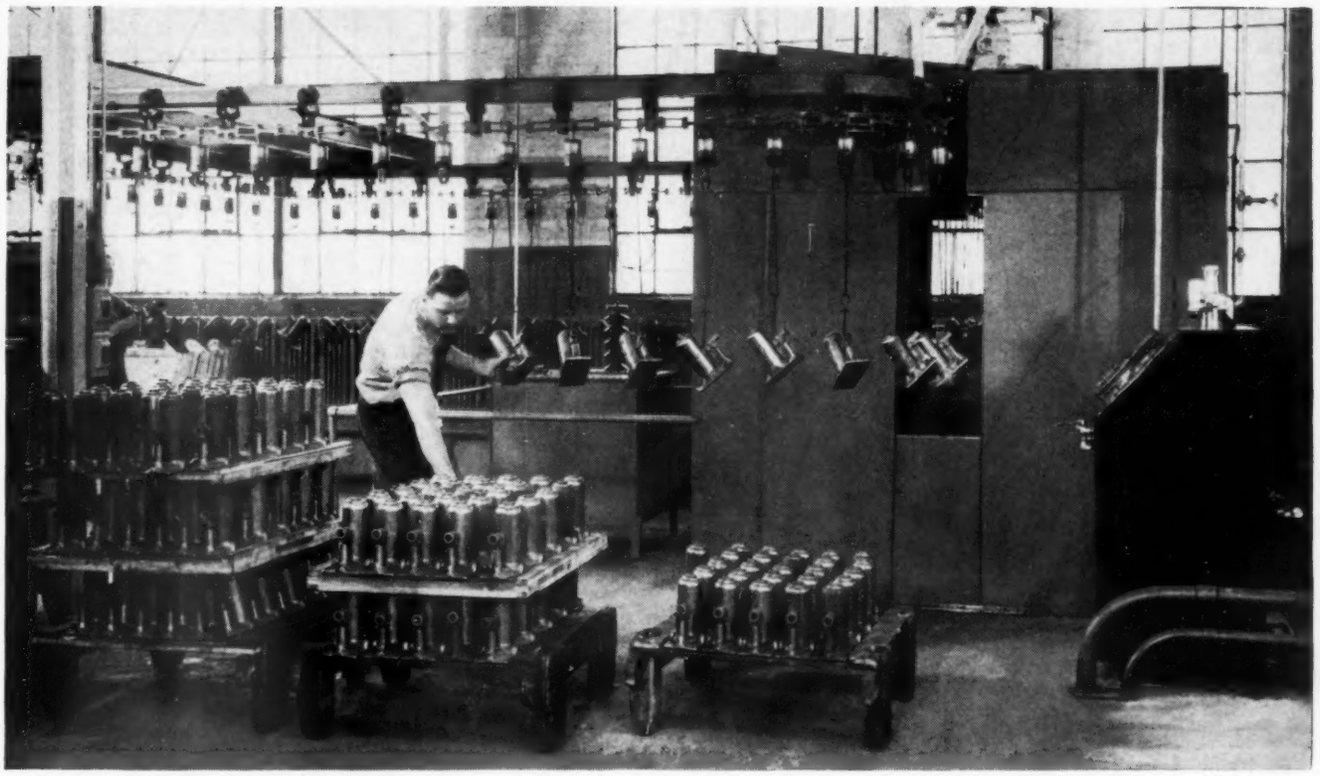
Automatic spray guns of conventional design are employed. These guns are used at lower than normal pressures, so special atomizing caps must be selected to suit the materials to be sprayed. Any material that can be atomized at these lower-than-normal pressures is applicable by this method. Usually, the finishing material must atomize satisfactorily at pressures of 20 to 25 psi. before good results are obtained. Materials now being applied successfully include ordinary lacquers and enamels, hammer-and-wrinkle finish materials, water-base as well as oil-base materials, oils and hot waxes. Vitreous enamels likewise can be applied.

Suitable coatings can be applied on items which naturally are, or can be made to be conductive electrically. In this group are all types of metal items, whether or not magnetic. Parts made of non-conductive materials, such as wood, plastic or ceramic materials, can be coated provided the parts are so shaped that they can be backed with a suitable electric conductor. Ceramic flower pots, for example, are inverted over metal conveyor fixtures which conform to the internal shape of the pots and establish the necessary conductivity. In addition to these electrical limitations, the parts must have reasonable exterior contours. Articles with deep recesses or excessive areas shielded by other parts of the exterior surface cannot be coated effectively because an electrical field cannot be established over such shielded areas. For the same reason, interior surfaces cannot be coated by this process.

The spray guns must be positioned properly within the spray booth to distribute the coating material uni-



Automobile steering wheels have an irregular contour difficult to finish satisfactorily by any automatic method. In this electrostatc spray-finishing installation, the wheels are supported on spindles carried on a floor-mounted chain conveyor and rotated while passing through the charged field. Two guns, one above and one below the wheels, apply a highly critical finish at a faster rate and with a heavier coat than is possible with other methods



Automobile jacks are spray-painted in this automatic booth. The electrostatc power-pack unit is inside the fence to the left of the booth, while the control cabinet is at the right. Two men operate this setup—the operator in the foreground hangs jacks on the conveyor, which then carries them through the booth. Finished jacks are removed by the operator in the left background

formly into the electrostatic field. The charged field will precipitate the atomized material onto the article, following the shortest path between the electrode system and the surface. For this reason, placement of the guns must be based upon the amount of material needed on each section of the surface to be coated. More than one gun is needed when the material cannot be distributed over a sufficiently wide area by one gun. Where conveyor speed is slow and the amount of material needed is relatively small, or in other cases where an advantage can be obtained by so doing, it is possible to use fewer guns and oscillate them to increase uniformity of distribution.

Guns usually are positioned about 1 ft. away from the electrode system and aimed at an oblique angle to the path of conveyor travel. In this manner the coating material usually is sprayed into the field approximately parallel to the conveyor. Positioning of the guns will vary from part to part, and will depend to a large extent upon the shape of the article to be coated. Where the contour of the part is such that more material is needed in one portion of the field than in another, more guns will have to be positioned to direct coating material into this area.

Because it is not always possible to direct the spray guns so they will spray coating material directly toward the electrode system the electrodes may slowly become coated with overspray material. In correctly engineered installations, however, this buildup on the electrode wires usually is not a serious problem and the electrodes should not require cleaning any oftener than the booth walls. In those cases where this may be an important factor, easily replaceable electrode systems can be provided to save time. The coated electrodes then can be cleaned to remove the oversprayed material while the finishing operation continues.

Conveyor Installations

The electrostatic spray system can be adapted to any of the standard types of industrial conveyors having metal parts. It is being used with overhead monorail conveyors, floor or overhead spindle conveyors, and with slat conveyors. In general, all items which can be rotated during passage through the spray booth should be rotated, because in this manner the uniformity of the coating material applied to the surfaces of the parts will be increased. By rotation, shielded portions of the exterior surfaces will be better exposed to the action of the charged field. If the parts are not rotated, more material will be applied on those portions of the surface subject to a large electric field and less on those areas where the field is weaker. Thus, portions of the surface close to the electrodes will receive the larger amount of coating material. This is a characteristic of the electrostatic process, and has nothing to do with the type of coating material being applied.

The process now is being used to coat many different products, including flat panels, metal table tops, metal folding chairs, metal radio tubes, flashlight cases, card tables, 5-gal. containers, covers for water heaters, refrigerator cabinets, electric lamp parts, metal wall tiles, bed springs, automobile steering wheels and window moldings, air and oil filters, automobile dash screens, structural sections and sheeting. Savings that can be effected depend upon the product and the type of finishing material employed.

Shape and size of piece being coated have an important bearing on possible

savings. Large savings can be expected on small parts where conventional methods are inefficient. However, on large sheets and other parts where hand or automatic spraying is more efficient, savings are less. In general, use of the electrostatic process has been found to reduce the amount of finishing material required by 40 to 60%. One installation employed for spray-coating metal radio tubes has resulted in a paint saving of 62% over high-pressure automatic spray painting. Curtain rods are being coated five times as fast as with other methods, and 75% of the paint is saved. Stove hardware and similar parts are being finished electrostatically at twice the number of parts per gallon of coating material.

In general, the principal advantages that can be claimed for this system include: (1) process is fully automatic and requires only one operator at the spray booth, with one or two helpers to unload and reload parts on the conveyor, (2) coating material required per part is reduced materially, (3) booth cleanup time is reduced much because overspray is minimized.

THE FOREMAN { SUPERVISOR MANAGER TEACHER

It's up to the foreman to list his specific duties and insist that management define bounds of his administrative authority

BY ROBERT J. SPENCE

A FOREMAN can get very little assistance from management or precedent in trying to learn exactly what his duties are. There are several reasons for this. One is that jobs of all foremen differ, even in the same shop. Another is that new responsibilities are continually being thrust upon him which require immediate attention and upon which he must act to the best of his ability.

Also, the distinction between a foreman's supervisory responsibilities and managerial duties is closely drawn at times and can be confusing. This is complicated by the fact that both responsibilities are carried on simultaneously. Then, too, besides being supervisor and manager, the foreman is always a teacher.

For these reasons, no one can tell an individual foreman what his job should be. Whatever advice can be given can be advanced only as generalities. But even generalities can point toward solving problems.

No foreman can approach 100% efficiency if he performs his job in a hit-or-miss manner and without a logical plan. His efforts must have method or system and be under definite control. He must have a clear vision of the scope and responsibilities of his duties and be in a position to take the best possible action.

This clear vision can be obtained by a definite listing of the duties and elements of his departmental job, and, if possible, a daily program so scheduled as to conserve time and personal health. In this listing there should be a complete analysis in which there is a formal classification, then the different headings, then the various groups under the headings, and then the detailed responsibilities under each item in the group. Under the detailed responsibilities can be subdivisions of his various specific responsibilities.

The classification would be "The Foreman's Job," the headings would be "The Foreman as Supervisor, Manager, Teacher." Then each heading would be divided into its various groups.

But before analyzing his job, he should first make clear in his own mind just what the distinction is between his supervisory and managerial responsibilities. It can be stated about like this: As a supervisor he notes that a machine is in poor condition; as a manager he has it repaired, giving attention to such a thing as the best time for repair so as to have the least interruption in the flow of work. As a supervisor he sees that work is being spoiled through carelessness; as a manager he instructs the workman or deals with him otherwise. As supervisor he sees that the Big Boss without the foreman's previous knowledge, has taken a workman from his department job to do private work; as a manager, he insists on complete departmental rights and courtesies. As supervisor he discovers a defective elevator cable; as a manager he takes steps to have it repaired or replaced.

In general, the supervisory observation precedes the managerial action. The supervision calls for observation of conditions in both the department and plant and the managerial phase calls for remedial action in the most effective manner.

A foreman is not a foreman until he learns that he has privileges as well as duties, and that his overseeing duties can be balanced with managerial authority with advantage to himself and the department. That is, responsibility and authority should be on a par. It is a glaring fault in many foremen that they are afraid of overstepping their station if they take administrative action. If they have such a fear they should go to management and have the line of demarkation defined. In the majority of plants they will find that the trend of management is to clear away the old traditional fears of foremen and to try to develop a stronger managerial instinct.

Analyzing a foreman's job into its actual parts has the advantage of placing the full details of the job on a plane where the foreman can look down upon it from a height and see each detail and the immensity of it. And with such an analysis many a harried foreman can show clearly where it will pay the firm to give him clerical assistance in the handling of "paper" and other things; in better delivery and inspection of incoming materials; in a more frequent adjustment and overhauling of tools and equipment; and in more prompt attention to requests for needed information from immediate superiors.

ROUND TABLE

Is Rabble-rousing Worth A Premium?

"I see where they figure they'll have to write the history books all over, again, now that the war's over. They'll be telling about the glories of Hitler and Tojo, just like they told about Napoleon and Genghis Khan." Ed was plainly irritated, and making no effort to hide it.

"Well, Ed, it's only when they can find people sheepish enough to follow 'em that conquerors get anywhere. Wherever you have a leader, good or bad, you have to have followers, you know."

"Listen, the average guy just goes along for the ride. You can't tell me that the average Jap or average German was taken in by all that paradin' and spoutin.' He just didn't bother."

"Maybe so, Ed. But because they didn't bother, as you put it, the guys in the saddle turned the world upside down. Seems like all of us humans can't help listening to some guy with a silver tongue. We go for the rabble rousers."

"Not always, Al, from what the minister says. He said Moses wasn't much of a talker, but his brother-in-law or somebody, a guy named Aaron, was his mouthpiece."

"Like the boys selling soap on the radio, eh? Somebody else writes what they say, but they make it sound almost good enough to eat. But we've always been suckers for the sweet talker, Ed. Where do you think we get salesmen, politicians and labor leaders? Most of those guys hold their jobs because they're snake charmers."

"What gets me is the way those guys get paid for what they do. We work like dogs to make the stuff and get paid a lot less than the salesmen who peddle it. It's our hard work that supports those peddlers."

"Not only the peddlers, but the management, Ed. None of 'em is what you'd call productive labor. They live off of what the men do. So do we, if you want to think about it that way. We get paid a little better than the boys because we can get away with telling 'em what to do."

"You're crazy, Al. We get paid because we know how to do the job better than the men who are on it. We are pinch hitters, so to speak. But them salesmen! Most of 'em can't even figure out how the thing they're sellin' works. And the same thing is true about the union leaders. They collect big dues and draw big salaries, and for what? For startin' strikes that pull members off the job. But did you ever hear of a union leader that went on strike and lost his income like his boys do?"

"Look, Ed, most of the union leaders and most of the salesmen have a job to do, too. Their job is to sell ideas. They've got to make people believe what they say—make 'em buy what they have to sell. That takes a special kind of ability, just as it takes a special kind to be an engineer or a boss. Any special skill gets special pay; you know that."

"Too special, Al if you ask me. I claim we pay too much to the guys that talk, and not enough to the guys who do the work."

***DO WE PAY** too much to leaders of people? Is the ability to get other people to do what you advocate worth the premium that is placed upon it? Your opinions are of interest to others and may help clarify this confusing problem. Discussions of earlier topics appear on later pages.*

Good Threads Depend On Attention to Chaser Details

Cut-and-try methods are sometimes necessary to determine the best top rake and bearing for a given job. Care in resharpening pays off in longer chaser life

BY H. SCHLARMAN

WHEN conditions external to the diehead are right, but trouble from drunkenness, taper and rough finish is still experienced, the top rake or, more important, the bearing may be wrong.

Because of the variety of materials cut today, the standard rake grind used for SAE 1020 may not work on other steels and positively will not work on materials like ST 17 or ST 24 aluminum. Whereas SAE 1020 cold-rolled steel may take a 22° top rake and an 0.008- to 0.018-in. cutting bearing, this rake grind would probably cause a drunken, tapered and poorly finished thread on ST 17 aluminum, as ST 17 requires less top rake and more bearing. Even among steels, different rake grinds may be required because of sponginess, stringiness or hardness of the stock.

When the standard rake grind fails to produce the required thread, the usual procedure on tangent and circular chasers—where definite means of measuring rake bearing and of setting the chaser are provided—is: Pick a top rake normally used for the material, as 20°, and sharpen the chasers with a heavy cutting bearing. For instance, if the original cutting bearing was 0.010 in. above center, resharpen the chasers with a 0.020-in. cutting bearing. Of course, the end grind bearing should also be increased in proportion.

Cut five or ten samples. Then regrind the rake only, lowering the bearing 0.002 or 0.003 in., and cut a few more samples. Continue doing this until the chasers produce a shattered thread.

Then resharpen the chaser with 15° and 25° top rake, and follow the same procedure as before relative to the rake bearing. By keeping the samples and a record of the grind used, the best top rake and cutting bearing for the material can be found. The best bearing will be a few thousandths heavier than that at which chatter or drunkenness started to show.

As ordinary yellow brass will not stand much of any top rake, the first rake grind would have no top rake. The next top rakes used would be 5° bevel and 5° hook. The bearing procedure would be the same.

Although the man who knows threads can usually shortcut this process, there are times when even he has to follow it through step-by-step to find the correct rake grind for a cranky material. The above emphasizes the value of a die and chaser design that permits definite measurement and setting of the chaser.

The information given in preceding articles on the radial, tangent and circular chasers, was based on the general principles controlling that particular type of chaser. No attempt was made to tie these principles to their definite application on present available equipment. However, anyone thoroughly understanding these articles could handle any make of chaser regardless of its individual characteristics of design.

The rest of this article, except where it specifies the radial chaser, holds true for any type of chaser. One of the first "don'ts" on any type of chaser is: Don't try to resharpen chasers freehand. When resharpening any type of chaser always use the grinding fixture recommended by the die manufacturer. If the user, for some reason of his own, makes his own fixture, it should be so designed as to hold the chaser in the fixture locating from the same surfaces as used in the diehead.

Don't run chasers so long that the chaser teeth break because of extreme dullness. Chasers will often cut even after they are so dull that they should have been resharpened, especially on the less-accurate threads.

Although the run may be a little longer than if they are taken out at the proper time, this practice does not pay. It usually necessitates grinding the chasers twice as much as normal, which would add up to swapping 1½ runs for 2 besides extra downtime on the machine.

Over-dullness of chasers causes: (a) chaser-teeth breakage; (b) ruining chaser-teeth form; (1) excessive grinding; (d) needless diehead wear, and (e) scrap.

The problem of over-dullness is far more critical on the radial chaser. Regardless of how much must be ground off the long life type of chaser, it can always be brought back to its original degree of sharpness. This isn't true of a radial chaser even when resharpened at the proper time.

A radial chaser that has been run too dull is often ruined. The dullness of the cutting edge throws a strain on the guiding teeth that causes excessive rub and ruins the tooth forms. Once this happens the chasers are ruined.

Further, there is usually tooth breakage or flaking on the step. Sometimes the broken tooth can be removed. However, if there is flaking of the step, the chaser may be of no further use.

From the standpoint of production, elimination of troubles and chaser life, a profitable procedure is to resharpen chasers before it is absolutely nec-

essary. This is especially true on radial chasers.

Chasers should not be burned in resharpening, or what is worse still, burned and then dunked in cold water. This causes loss of hardness at the cutting edge as well as grinding checks (cracks) which shorten chaser runs because of chipping.

Use a soft wheel that will give a good finish and will not burn. Take the time to sharpen the chasers properly. The results will repay you manyfold.

On number-size chasers, a harder and finer-grit wheel should be used to obtain a smooth grind. As a 64-pitch thread is only 0.010 in. deep, a grinding scratch 0.001 in. deep would be a tenth of the tooth-thread depth.

All chasers having helix angle are matched at the factory. The same identification symbol is put on each chaser in the set. This helps in reassembling the chasers in their proper sets if they get scattered.

Don't try to match chasers with helix from one set into another. It is generally out-and-out luck if they work, because no effort is made to keep the first chaser thread always in the same relative position. Consequently, freehand matching results in ruined thread or cross-threading because of off-spacing. Chasers without helix can be shifted from one set to another.

On automatics using revolving dies, plunge-cut taper chasers will invariably leave one or more marks showing where the chasers have finished cutting unless the diehead is designed to allow a slight wiping action at the start of chaser withdrawal. These plunge-cut taper chaser marks can usually be more easily eliminated when threading with the stationary die. When production warrants, receding heads, if available, are preferred. Always taper-form the blank for taper threading to a good class of fit on steel product work.

Topping chasers are supposed to turn the outside diameter of the stock to form the crest of the thread as well as cut the thread. Every once in a while some user gets the idea that he wants this type of chaser.

Not many chaser manufacturers will furnish this type. If they do, it will be under protest. The reasons are that shorter chaser life and torn threads will result. If the outside diameter is tapered and out of round, the thread may be tapered and out of round too. The National Screw Thread Commission gives definite tolerances below the nominal size so the chasers will not have to cut the outside diameter. Chasers are not designed to be turning tools. They are designed to cut the thread only.

Chasers should not be required to thread oversize stock. It will result in reduced chaser life both from wear and breakage, and will produce poor threads. If threading oversized stock is unavoidable, the chaser should be ground as previously shown to reduce the ill effects.

The normal chamfer is about three teeth including the first full tooth. The normal short chamfer is about 1½ threads. Chamfer length can be designated by the number of threads, by the length of neck on the stock

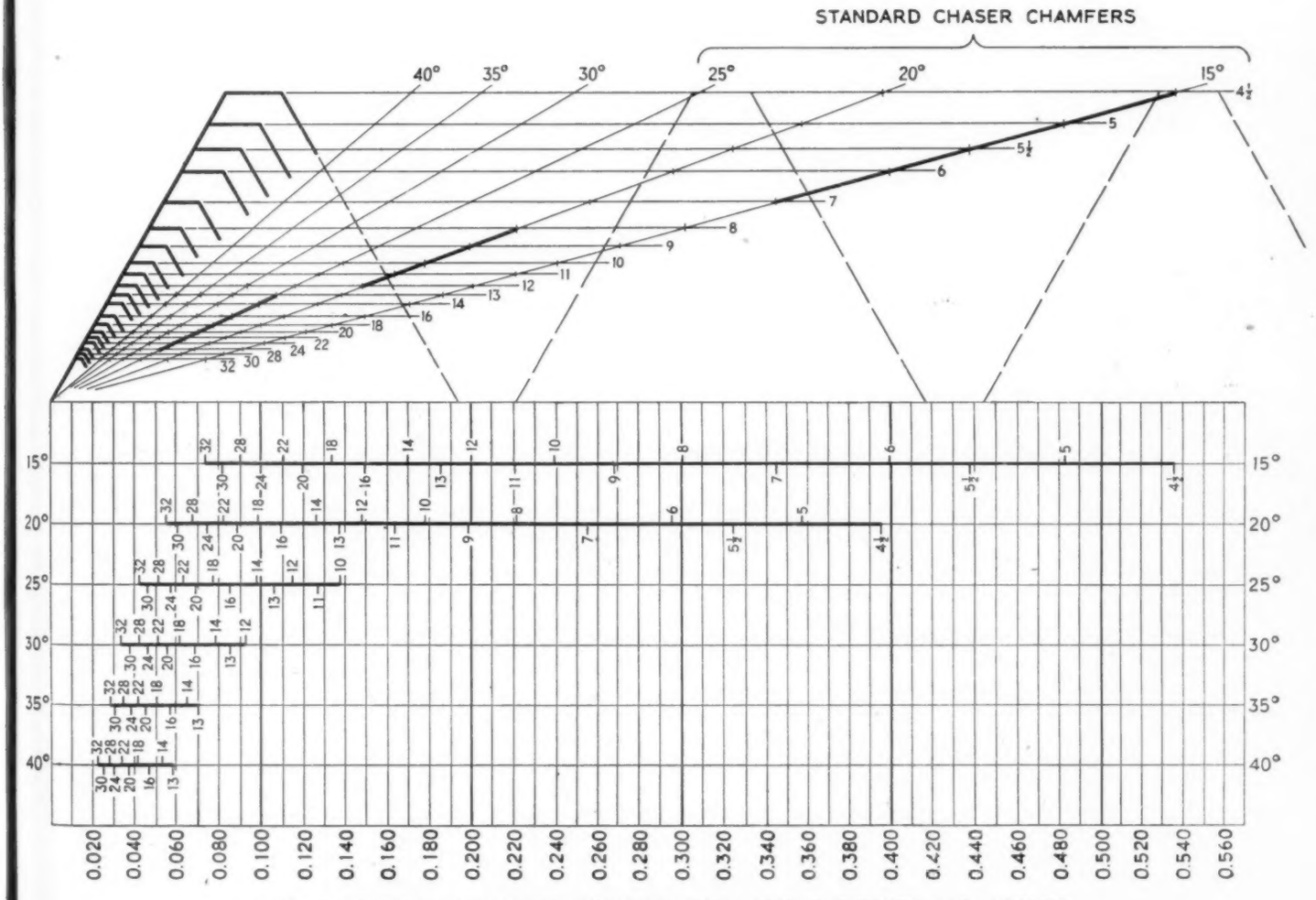


FIG. 52 — LENGTH OF CHAMFER IN INCHES FOR VARIOUS PITCHES AND ANGLES

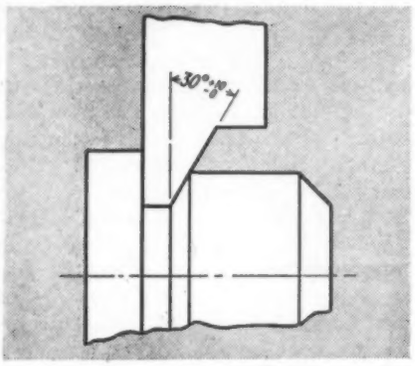


Fig 53—The necking tool should have an angle on the thread side to provide maximum clearance for chamfer

or by degrees, as for example an 18° chamfer. The angle is given with reference to the axis and not to the face of the diehead.

Chaser manufacturers have set up standard chamfer angles for the various pitches of thread which are fairly uniform. The standard chamfer, whenever possible, is used on steel or tough materials. The chaser will give better finish and more pieces per grind because there will be more teeth cutting, Fig. 52.

There is, however, a practical limit to the length of chamfer that can be used. Too long a chamfer, particularly on fine-pitch threads, is as bad as too little. The bite of each tooth of a fine-pitch chaser on an excessively long chamfer is so small that it is hard to start the thread without excessive taper on the first two or three threads or until the non-cutting teeth become engaged and can steady the cutting teeth.

On very coarse U. S. and acme pitches the chamfer can, if necessary, be lengthened to a maximum of four teeth, and the cutting teeth still have enough bite to give a good start on the thread. This can readily be understood. A four-pitch acme is roughly 0.125 in. deep. A 20-pitch U. S. is 0.032 in. deep. If four teeth are cutting on each pitch, each tooth will remove 0.031 in. of stock on the 4-pitch acme, and only 0.008 in. on the 20-pitch U. S. The chamfer on coarse-pitch chasers should be short enough to leave enough full teeth back of the chamfer to control the lead.

On jobs like oil-well sucker rods, where special conditions make it absolutely necessary to have chamfers too long for the pitch, the die must be controlled with a leadscrew to obtain threads without excessive taper in the starting threads.

Short or close-cutting chamfers should be avoided wherever possible. Short-chamfered chasers, because each tooth must remove more stock, dull more quickly and break more frequently. Furthermore, it is hard to get good thread finish. The tougher the stock the worse these conditions become.

The only time a short-cutting chamfer is helpful is on free-machining materials, mostly non-ferrous, such as ordinary yellow brass and aluminum. The heavy bite of the short chamfer is an advantage here as it will produce less taper in the starting thread.

Blueprints often show the thread neck with parallel sides. The necking tool is often made the same way, but it should be made as shown in Fig. 53. While still maintaining the specified width of neck, it provides more length in which the die can pull and incidentally less change of hitting the shoulder and breaking the chasers. Further, it chamfers the end of the thread removing the razor-sharp edge left on the end.

On 7-pitch and coarser, two cuts—roughing and finishing—are frequently necessary to complete the thread, 0.010 or 0.015 in. being left for the finish cut. Most radial stationary dieheads have a rough and finish lever so that both cuts can be taken with the same set of chasers by turning the lever either to rough or finish. However, when much production is involved it is more economical to have two dieheads, one for roughing and one for finishing. The roughing chasers are made to the helix of the roughing pitch diameter and the finish chasers to the helix of its pitch diameter.

Different Helix Angles

Threads of the same pitch, but of different pitch diameters, have different helix angles. The larger the pitch diameter, the smaller the helix angle. Also, the coarser the pitch and the greater the lead (as in double, triple, etc., threads), the greater is the differential in helix angle. Therefore, the helix angle of the roughing chaser is less than that of the finishing chaser. This causes a cramping action on the chaser teeth that is cause for breakage.

In coarse-pitch two-cut threading, the finish-cut chasers may break more often than the roughing chasers. The cause may be the glaze produced on the roughed thread due to the work-hardening characteristic of the material. Threads, not too coarse, may be produced in one cut by the proper chamfering of the chaser and correct work-speed selection. If this is not possible, leave enough stock for the finish cut so the chasers will start cutting under the glaze.

Threaders with leadscrew control are in some cases used to cut coarse pitches with the long-life chaser. However, long-life chasers are not in common on turret lathes for very coarse pitches.

Radial chasers must be lapped for two-cut threads if the threads are of any length or the nut engagement is over 1½ times the thread diameter. If they are not lapped, the operator will have difficulty in tracking the second cut over the first without ruining the thread form and lead on fairly long threads. If leadscrew control is used, a lapped chaser may not be required for the job.

TIPS for Top Shop Men

83 If a worker shows real proficiency, train him for another, better job—"just in case." He'll feel you're trying to help him. Don't let any man become an automaton. If you do, he stops thinking, both in the plant and outside.

84 Try to get movie films, slide films and booklets describing how your tools are made and how they are used to best advantage. Most manufacturers will be glad to lend or give you such material to show the "gang." Some government agencies also have excellent films available.

85 Psychological and psychiatric tests are coming into increasing favor. Sure, they're new-fangled, but they help to show which workers will get along together. Without them, you must decide and it's a tricky decision. Surface appearances may deceive.

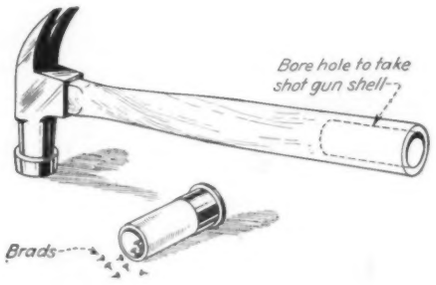
86 Fast judgment is a wonderful attribute—but snap judgment isn't. Don't take too much pride in your quick decisions—they may be as faulty as they are fast.

87 Be careful of worker skill and pride. Don't put your best man on the least-exacting job, just because he is available. His self-respect—and the respect of others for his ability—may be lost as a result of your picking the easy solution.

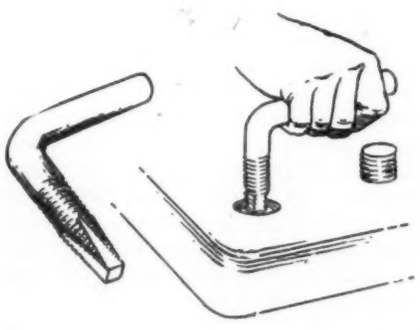
Short Cuts FOR THE SMALL SHOP

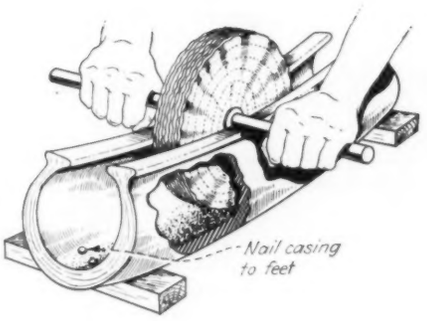
BY A. H. WAYCHOFF

A BRAD RECEPTACLE in the hammer handle is a great convenience to model makers. And a used shotgun shell is just the right size. To modify the hammer, bore a hole in the end of the handle to make a snug fit with the shell. Then when a few brads or tacks are needed, slip the shell out of the handle and spill a few near the point of use. And it's easy to flip unused brads back into the shell.

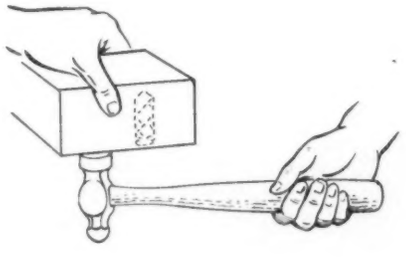


SCREW EXTRACTORS are easily made from junk turnbuckles, such as were used on brake connections on trucks and passenger cars. From the turnbuckle, remove the rod with the left-hand thread. File a tapered square on the threaded end, in order to produce a tap-like end. Then bend the rod to form a hand hold grip and cut to convenient length. Before using this extractor, drill a hole in the broken screw. Then enter the extractor in the hole and turn counterclockwise, so that the left-hand "tap" cuts a thread. After screwing down a few turns, the extractor will become tight enough so that the broken screw will start to back out.



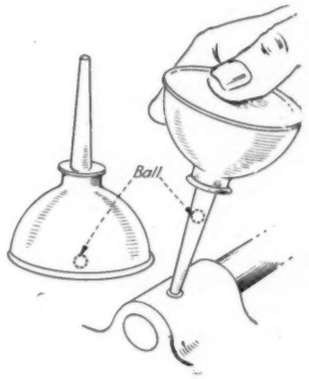


AN ABRASIVE-COATING trough that uses a minimum amount of polishing grain can be made of a piece of old tire carcass. Cut a piece of casing about 16 in. long, also two wood feet about 6 in. long, using 2x4's. Put the feet on a suitable support of the right height for rolling the glue-covered polishing wheel in the grain. Nail the casing to the feet from the inside, and into the supporting surface. It will be possible to nail the casing so that the trough formed is not too curved. But the depression has this advantage: less grain will be required than a flat-bottomed trough with corners.

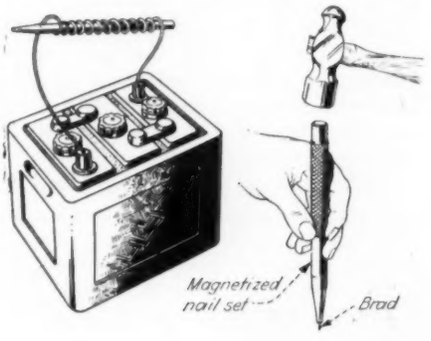


OIL WORKS wonders in removing broken twist drills. Instead of trying to dig the broken drill out of the hole, and getting into serious trouble, just pour a drop or two of oil in the hole. Then turn over the piece in and tap lightly with a hammer. The oil loosens the tiny chips that bind the broken drill, and tapping with the hammer causes the cutting lips to loosen their hold. The whole operation takes but a short time and can save a lot trouble.

A BALL BEARING makes a good measuring device for oil cans. Drop a bearing ball into the can. When the latter is used, the ball will roll into the spout and shut off the flow of oil allowing only the oil trapped between the ball and the spout end to flow into the bearing. A few trials with balls of various sizes will give the oil flow needed. This trick prevents an excessive oil flow and messing up the equipment.



BRADS ARE easily picked up with a magnetized nail set. And those ½ in. in length, or shorter, are held straight for driving in model building. To magnetize the nail set, wrap several turns of cotton-covered magnet wire around the tool and connect the free ends to the terminals of a storage battery for a few moments. The nail set will be strongly magnetized for some time. When the end of the nail set is touched to the head of the brad, the latter will be held point out and can be placed readily in hard-to-reach places, where it would be impossible to handle it with the fingers or pliers



Conjugate Pitch Surfaces

In the fifth article of this series the author explains the conjugate action of hypoid gears and its effect on their capacity

By Ernest Wildhaber, Gleason Works

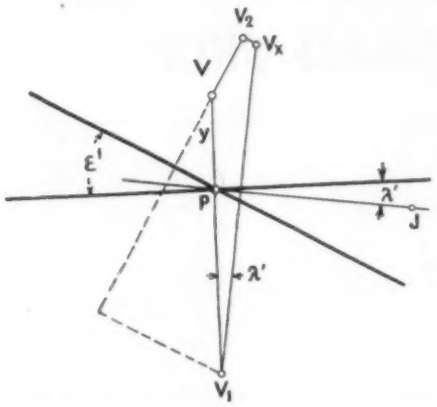


Fig. 31 — Pitch plane view of conjugate pitch surfaces showing determination of their relative curvature

WHEN THE GEAR teeth are curved lengthwise as described in the preceding article, the surface of action of one side of the teeth intersects the surface of action of the other side in a curve tangent to the pitch plane. At any point of the intersection curve, a straight line can be drawn, which intersects both axes, and which represents the intersection of two axial planes laid through said point and containing the pinion axis and the gear axis respectively. This straight line can be considered a normal to a pair of conjugate pitch surfaces, which contact along the curve of intersection of the two surfaces of action. The pitch surfaces are defined by the normals at all their points of contact. Their outlines in axial sections ordinarily are curved, and on at least one pitch surface the axial outline is concave.

The pitch plane is a tangent plane at point P of these conjugate pitch surfaces, and the pitch cones are their inscribed cones. These conjugate pitch surfaces are reintroduced for broadly deriving the tooth profile curvature.

The curvature at P in peripheral direction is known on both conjugate pitch surfaces. It is identical with the peripheral curvature of the inscribed cones. The radii of curvature are equal to the distances $A_p \tan \gamma$ and $A \tan \Gamma$ of point P from the intersection C_1, C_2 of the pitch plane normal with the pinion axis and the gear axis. Known also is the existence of line contact between these conjugate pitch surfaces; and the direction of their line of contact is known.

The quantity to be determined is the relative curvature $\frac{1}{\rho_{br}}$ of the conjugate pitch surfaces, in a direction perpendicular to their line of contact.

Fig. 31 is a view of the pitch plane, which is the tangent plane of the conjugate pitch surfaces. Consider a point V, which is displaced an infinitesimal distance y from P in the peripheral direction of the pinion. The pitch surface normal of the pinion at V is inclined to the pitch surface normal at P as if turned about an axis parallel to the projected pinion axis. The inclination angle is $\frac{y}{A_p \tan \gamma}$ measured in radians.

Point V has a distance $y \cos \varepsilon'$ from the projected gear axis. The pitch surface normal of the gear, at V, is therefore inclined at an angle $\frac{y \cos \varepsilon'}{A \tan \Gamma}$ in a direction perpendicular to the projected gear axis; and it is also inclined in a direction parallel to the projected gear axis at an angle as yet undetermined.

These inclinations can be plotted by projecting a unit distance of the normal to the pitch plane. Thus distance $VV_1 = \frac{y}{A_p \tan \gamma}$ expresses the inclination of the pinion normal; and $V V_2 = \frac{y \cos \varepsilon'}{A \tan \Gamma}$ expresses the peripheral inclination of the gear normal. Of the inclination V_2V_x only the direction is known.

The normals at V to the two conjugate pitch surfaces are relatively inclined, as if turned about an axis parallel to their line of contact PJ. This relative inclination is expressed by a line V_1V_x drawn at right angles to the line of contact. V_x is the intersection formed by lines V_1V_x and V_2V_x. Omitting the common factor y,

$$V_1V_x = \frac{\cos \lambda'}{\rho_{br}}; \text{ also}$$

$$V_1V_x \cos (\varepsilon' - \lambda') = V V_2 + V V_1 \cos \varepsilon' = \frac{\cos \varepsilon'}{A \tan \Gamma} + \frac{\cos \varepsilon'}{A_p \tan \gamma}$$

$$\text{(26)} \qquad \frac{1}{\rho_{br}} = \frac{\cos \varepsilon'}{\cos (\varepsilon' - \lambda') \cos \lambda'} \cdot \left(\frac{1}{A \tan \Gamma} + \frac{1}{A_p \tan \gamma} \right)$$

The normal direction of the teeth is inclined at the angle $(\psi_p - \lambda')$ to the section considered above, which is taken at right angles to the line of contact. The relative curvature $\frac{1}{\rho_{bn}}$ of the pitch surfaces in normal direction therefore amounts to

$$\text{(27)} \qquad \frac{1}{\rho_{bn}} = \frac{\cos^2 (\psi_p - \lambda')}{\rho_{br}}$$

Mesh in the Normal Plane

In the normal plane which passes through pitch point P and is perpendicular to the pitch tangent t , the conjugate pitch surfaces are intersected in curves k', k'', Fig. 32, whose relative curvature appears in formula (27). At one moment the mating pitch lines of a pair of tooth surfaces pass through mean point P. After the gears are turned through a series of infinitesimal angles at the required ratio, the pitch lines have moved, so as to intersect the normal plane at a series of points marked on the curves k', k'', such as points G', G''.

It has been previously pointed out that a definite imaginary tooth surface, of a pressure angle equal to the limit pressure angle, tends to stay in contact at the same points during infinitesimal rotation of the gears. In other words the path of contact then extends in a direction tangent to the pitch surfaces.

T_1, Fig. 32, is the tangent to such an imaginary tooth surface. It is inclined at the limit pressure angle ϕ_o to the pitch normal P_n. Tooth profiles in the direction of this tangent tend to stay in contact; and corresponding pitch points, such as G', G'', are displaced in a direction parallel to tangent T_1, provided that only infinitesimal displacements are considered. In other words, corresponding pitch line points of hypoid gears approach each other and separate in a direction inclined to the pitch normal at the limit pressure angle ϕ_o.

For comparison Fig. 33 shows a normal section laid through the pitch surfaces of a pair of spiral bevel gears or helical gears. On such gear pairs, whose axes are in the same plane, the limit pressure angle is zero. Corresponding pitch-line points approach each other and recede from each other in a direction along the pitch normal P_n, at right angles to the pitch surfaces, in the immediate and infinitesimal vicinity of the pitch point. This is true also for normal tooth profiles. On hypoid gears the normal tooth profiles move into engagement in a general direction inclined at the limit pressure angle to the pitch normal.

Contact on Opposite Side

Normal tooth profiles of a hypoid gear pair are shown in contact on one side of the teeth in Fig. 34. Fig. 35 illustrates the contact on the opposite side. Again infinitesimal distances only are considered. The profiles contact at point K, Fig. 34.

$GP = GP_2 \tan(\psi_p - \lambda')$, see Fig. 30

$$GK = GP_2 \tan w = GP \frac{\tan w}{\tan(\psi_p - \lambda')}$$

The inclination i_n of the path of contact in the normal plane can be obtained from triangle GKP whose angle at G is $(90° - \varphi)$. With $\tan w$ as determined by formula (23), GK becomes

$$GK = GP \frac{\sin(\varphi - \varphi_o)}{\cos \varphi_o} \frac{\tan(\psi_p - \lambda)}{\tan(\psi_p - \lambda')}$$

Ordinarily the angles λ and λ' are very little different so that $\tan(\psi_p - \lambda')$ approximately equals $\tan(\psi_p - \lambda)$, and

$$\frac{GK}{GP} = \frac{\sin(\varphi - \varphi_o)}{\cos \varphi_o}$$

This proportion is fulfilled when

$$i_n = (\varphi - \varphi_o)$$

for angle GKP is then $(90° + \varphi_o)$. This inclination of the path of contact, in the normal section, compares with an inclination $i_n = \varphi$ on spiral bevel gears.

On hypoid gears the path of contact is not in the direction of the tooth normal, but is inclined away from it by the limit pressure angle.

Profile Curvature

Line $G'G''$, the connecting line of corresponding pitch line points, is parallel to tangent Ti and inclined at $(\varphi - \varphi_o)$ to line GK. Although distance $G'G''$ appears as a substantial quantity in the drawing, it is actually infinitesimal, infinitesimal even as compared with distance PG.

The profiles KG' and KG'' have a normal separation of $G'G'' \sin(\varphi - \varphi_o)$ at or near point G. This is equal to

$$\frac{GK^2}{2\rho_r}$$

wherein $\frac{1}{\rho_r}$ denotes the relative curvature of the normal profiles at point P, and at point K at an infinitesimal distance therefrom.

$$G'G'' = \frac{GP^2}{2\rho_{bn} \cos \varphi_o}$$

$$\frac{GP^2 \sin(\varphi - \varphi_o)}{2\rho_{bn} \cos \varphi_o} = \frac{GK^2}{2\rho_r}$$

(28)

$$\frac{1}{\rho_r} = \frac{1}{\rho_{bn}} \frac{\sin(\varphi - \varphi_o)}{\cos \varphi_o} \left[\frac{\tan(\psi_p - \lambda')}{\tan w}\right]^2$$

$$\frac{1}{\rho_{bn}} = \cos^2(\psi_p - \lambda') \frac{\cos \varepsilon'}{\cos(\varepsilon' - \lambda') \cos \lambda'} \left(\frac{1}{A \tan \Gamma} + \frac{1}{A_p \tan \gamma}\right)$$

This general formula of relative curvature applies to both sides of the teeth, provided that the pressure angle φ is positive on one side, Fig. 34, and negative on the opposite side, Fig. 35.

The section perpendicular to the line of contact is inclined at angle w to the described normal section, which is perpendicular to the pitch line tangent. The relative curvature of the section perpendicular to the line of contact therefore amounts to $\frac{1}{\rho_r \cos^2 w}$

Formula (28) is general and applies to all cases. Angle w has been determined previously for the specific cases where the tooth side of the gear or of a basic member is a surface of revolution, whose axis is contained in the normal plane and passes through curvature center C_n. Angle w is then defined by formula (23). For these cases, formula (28) can be transformed into (28a)

$$\frac{1}{\rho_r} = \frac{1}{\rho_{bn}} \frac{\cos \varphi_o}{\sin(\varphi - \varphi_o)} \left[\frac{\tan(\psi_p - \lambda')}{\tan(\psi_p - \lambda)}\right]^2$$

This formula expresses the relative curvature of the tooth surfaces in the normal plane. The individual curvatures relatively to the tooth surface of the basic member are then

$\frac{\cos^2 w}{\rho_{wg}}$ on the gear, and

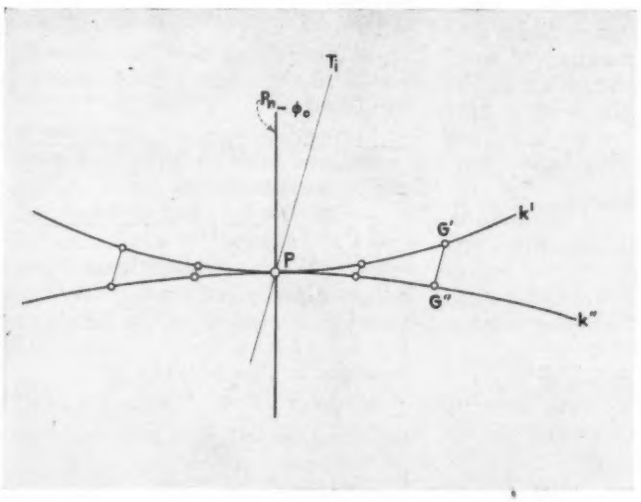


Fig. 32 — Plane section through a pair of conjugate pitch surfaces taken normal to the direction of the teeth, showing with exaggeration several infinitesimal turning positions. During the motion of the gears, corresponding pitch line points approach each other, coincide at pitch point P, and then separate. In the region immediately adjacent pitch point P they approach and separate in a direction T_i inclined at the limit pressure angle to pitch plane normal P_n

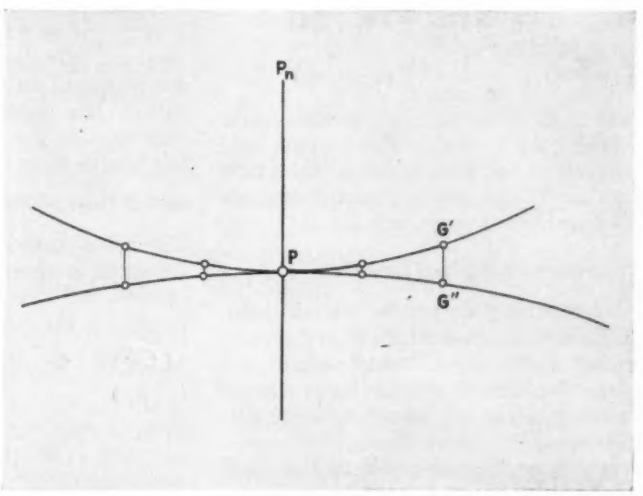
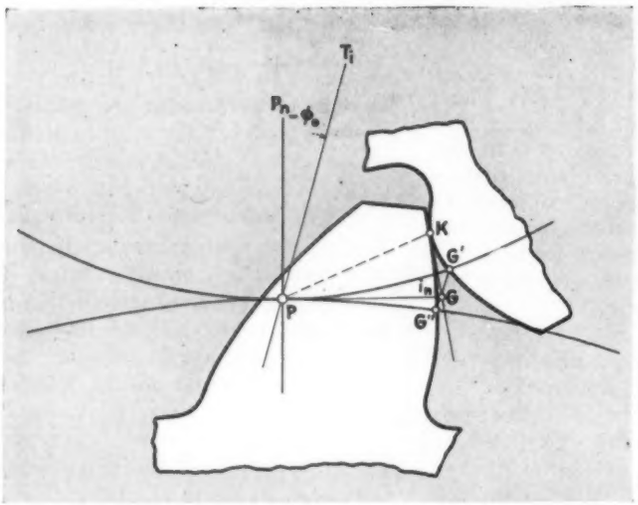
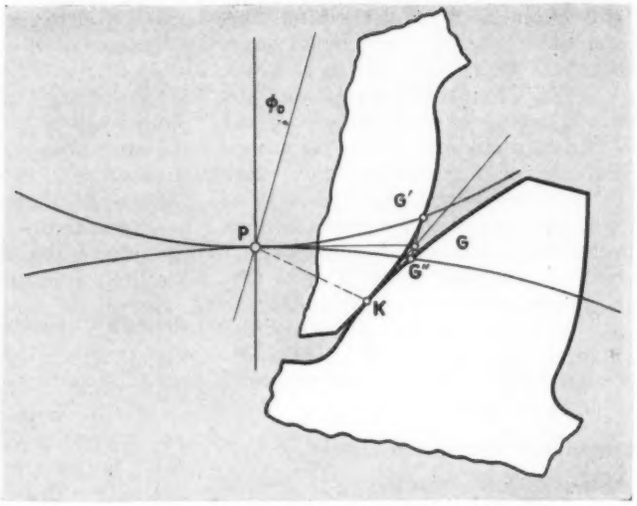


Fig. 33 — A section, like Fig. 32, but relating to spiral bevel gears or helical gears. Here corresponding pitch line points approach and recede in the direction of the pitch plane normal P_n, in the immediate and infinitesimal region around pitch point P. The relative path of a pitch line point is here perpendicular to the pitch surface immediately before and after contact is made





Figs. 34 and 35—Normal sections through a pair of hypoid gears, relating to opposite tooth sides. The profile curvature at pitch point *P* and the inclination i_n of the path of contact *PK* are derived by considering infinitesimal displacements *GP*. The relative profile curvature and the relative curvature of the pitch surfaces are directly related to each other

$\frac{1}{\rho_r} - \cos^2 w$ on the pinion, in the normal plane.

On spiral bevel gears, $\varepsilon'=0$, $\lambda'=0$, $\lambda=0$, $\phi_o=0$, $\psi_p=\psi$. Formula (28) can then be transformed to

$$\frac{1}{\rho_r}=\frac{\cos^2\psi}{\sin\phi}\left(\frac{1}{A\tan\Gamma}+\frac{1}{A_p\tan\gamma}\right)$$

On hypoid gears of two to one ratio and larger the angles λ and λ' are small angles, and an approximation can be had by neglecting them. Formula (28a) then becomes

$$\frac{1}{\rho_r}=\frac{\cos^2\psi_p\cos\phi_o}{\sin(\phi-\phi_o)}\cdot\left(\frac{1}{A\tan\Gamma}+\frac{1}{A_p\tan\gamma}\right)\text{ (approx.)}$$

which is very similar to the spiral bevel gear formula. The contact and curvature of the teeth is therefore similar to the contact and curvature of spiral bevel gear teeth.

Hypoids vs. Spiral Bevels

Comparing drives of equal mean diameter and face width *F* on the gear, equal ratio, equal tooth depth and normal pitch p_n, that is equal normal spacing, there are however these differences:

(a) The line of mesh in the pitch plane is longer on hypoid gears, namely substantially $\frac{F}{\cos(\varepsilon'-\lambda')}$, Fig. 30. The average number of teeth in pitch line contact is thus

$$\frac{F}{\cos(\varepsilon'-\lambda')}\cdot\frac{\sin(\psi_p-\lambda')}{p_n}$$

(b) The load, which is normal to the teeth, is somewhat smaller on hypoid gears, on account of the smaller gear spiral angle generally used. The proportion of the normal load to the tangential or useful load is $\frac{1}{\cos\psi\cos\phi}$.

(c) The hypoid pinion is increased in diameter as well as face width, as compared with a spiral bevel pinion. The diameter increase is at the proportion $\frac{\cos\psi}{\cos\psi_p}$.

To obtain a comparative characteristic of the over-all surface capacity of the gear pairs based on surface stress, a very fine normal pitch p_n and a correspondingly large number of teeth are assumed on the gears for simplification. The depth of the teeth is proportional to the normal pitch p_n, and the length of an individual line of contact is then proportional to $\frac{p_n}{\cos\phi\sin w}$

The relative radius of curvature, in a direction perpendicular to the line of contact, is $\rho_r\cos^2 w$ at the mean pitch point, see formula (28a). The product of the two factors, $\frac{p_n}{\cos\phi\sin w}\rho_r\cos^2 w$, is a measure of the surface capacity of an individual tooth at full contact without ease-off. The gear pairs are assumed to be equally eased off, so that in the comparison ease-off does not require consideration. The above product has to be multiplied by the number of teeth in simultaneous pitch-line contact, which is $\frac{F}{p_n}\frac{\sin(\psi_p-\lambda')}{\cos(\varepsilon'-\lambda')}$ and by the proportion $\cos\psi\cos\phi$ of the tangential load to the normal load. The surface capacity factor thus obtained becomes after transformation

$$F\frac{\tan(\psi_p-\lambda)}{\tan(\psi_p-\lambda')}\cdot\frac{\cos\lambda'\cos w\cos\psi}{\cos(\psi_p-\lambda')\cos\varepsilon'\left(\frac{1}{A\tan\Gamma}+\frac{1}{A_p\tan\gamma}\right)}$$

On ratios larger than two to one, the member $\left(\frac{1}{A\tan\Gamma}+\frac{1}{A_p\tan\gamma}\right)$ is substantially proportional to $\frac{\cos\psi_p}{\cos\psi}$.

Face width *F* is the same on the compared gear pairs, and can be omitted. $\frac{\tan(\psi_p-\lambda)}{\tan(\psi_p-\lambda')}$ is practically equal to unity on the considered ratios, so that for those the surface factor *S* can be simplified to

$$\frac{\cos^2\psi}{\cos\psi_p\cos(\psi_p-\lambda')}\cdot\frac{\cos\lambda'\cos w}{\cos\varepsilon'}$$

and approximately to

$$S=\left(\frac{\cos\psi}{\cos\psi_p}\right)^2\frac{1}{\cos\varepsilon'}$$

because λ' is a small angle, and $\cos w$ is substantially the same on the compared gear pairs. On spiral bevel gears $S=1$.

Example 1: $\psi_p=50°$, $\psi=25°$, $\varepsilon'=\psi_p-\psi=25°$.

$\frac{\cos\psi}{\cos\psi_p}=1.41$; $S=2.19$.

Example 2: $\psi_p=35°$, $\psi=10°$, $\varepsilon'=25°$

$\frac{\cos\psi}{\cos\psi_p}=1.20$; $S=1.59$.

The surface capacity of the considered hypoid gears is seen to be substantially larger than for spiral bevel gears, about 119% larger in the case of the 50° pinion spiral angle. This larger surface capacity makes up for increased sliding of the teeth.

TALKING SHOP

Nailed Ingots

REPLACING paint, Carnegie-Illinois plants are now nailing identification tags on ingots. A 2¾ lb. hammer with spring attachment to hold a heat-treated ¼-in. nail, which in turn holds the metal tag carrying the heat number, does the trick. Even a gal can swing the hammer.

Good-bye Mr. Chips

MAKERS of chip-conveying systems figured that their business postwar would be somewhat less than during the war. Not so. Many companies are installing systems now, to get rid of the chips that accumulate under modern machining conditions. The day of the wheelbarrow and shovel is passing. Next question: What happens if we get precision casting and forging developed to the point that heavy chip removal is not required?

Wal, Shet Our Trap (Plastic)

ANIMAL TRAP COMPANY of America has just announced purchase of Gilbert Clocks' Molded Products Division, and says initial production at the factory at Lititz, Pa., will be pressure-molded duck decoys. What, no better mouse trap?

Shop Philosopher

ED DAILY, head of jig and fixture repair, Curtiss-Wright, Columbus, is a philosopher. Here are two gems:

"Any time a man thinks he is indispensable, just let him lay off ten days, and when he comes back, find out how nicely the shop is running."

"Lost is the man who falls behind in progress; fortunate is he who keeps up with progress; *wise indeed is the man who sees ahead of progress.*"

Shopese

ADVOCATES of Basic English should take some heart from the fact that shopmen, blessed with a vocabulary enriched not only by thousands of specialized technical terms but also by lurid, purple cusswords, nevertheless persist in their use of general terms. There's "dolly" for a small bar or a hand-powered truck, "hickey" for a special wrench or bar of any description, "gadget" for the more-general variety of the same, "kink" for an idea or improvement, "doozie" for an extra-special of the same. Which reminds us that our favorite Hickey (first name Jim) was the boss's stooge, who took shorthand, typed and kept the books for a small plant. His only fall from grace was once when he worked out a kickback deal on the scrap. When detected, he took the pledge and the second chance the boss offered him, kept the first and made good on the second.

Radiant Heat

IN DESIGNING that new heating system, better consider radiant heat. By providing heat from large areas of floor, it avoids heat-distribution problems in a high-ceilinged building, keeping floors dry and preventing "baking" of employees near radiators while men farther away are cold. Further, opening a large door doesn't cause the usual tremendous heat loss and slow recovery. Hot water seems to be the preferred medium — circulators and converters are cheap and this system avoids construction and condensate-drainage problems.

Anti-Sapphire

ASSOCIATED PRESS reports a Russian engineer has developed ball bearings to replace jewels in watches. Balls are said to be so small 50,000 will fit in an ordinary matchbox. Diameter of the ball is reported as 1.5 mm. (0.0039 in.). Just when we got sapphire nicely synthesized too!

A NON-SHOPMAN is a guy who sees a laugh where you don't expect him to. For example, our news editor and staff economist, Ben Corrado, turns up with this group of shockers:

ROTARY SAW—The fellow who always falls asleep at Rotary Club luncheons.

MILLING CUTTER—(boxing' term) A dirty in-fighter.

PRECISION CASTING—Putting your fly right in the center of the swirl.

LATHE BED—Where the night lathe operator sleeps.

PLANER—An aviation enthusiast.

NEGATIVE RAKE—The kind of wolf that makes the girls say, "No!"

AUSTENITIC—Type of rheumatism developed by tall people who ride around in Austins.

FIXTURE — What your enemies threaten to do to you.

WELDMENT—Good intentions.

SHAPER—A pinup girl.

MARTENSITE—Place where Marten was born.

Want to join the Corrado Quip Club?

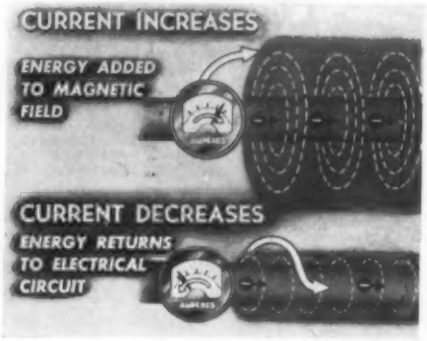
Roll Out the Barrel

WHEN WE WERE very young, we had a piecework job drilling twin holes in a 40-lb. draft key for a railroad car. To speed the handling from outside stacks, we set a barrel beside the drillpress as a transfer table. Our production—at 2c a key—rose from 26 to 40 per hr. But after a couple of months, the barrel collapsed—and we were bawled out by the shop foreman for destroying company property.

Pallbearers

A MATERIALS-HANDLING expert died. Six men from the plant were carrying him to his final rest when he rose up and shouted, "If you'd palletize this casket, one man with a fork truck could do the job faster and better!"

Inductance



Inductance is the change in magnetic energy caused by an increase or decrease in the current flow

LET'S START with a basic fact that electrons flowing through a conductor form a current of electricity. In the space surrounding every conductor of electric current, there is a field of magnetic energy. This field is invisible, but picture it as a mass of overlapping lines of force traveling at right angles to the conductor. This is the same type of invisible magnetic field as that produced by a simple horseshoe magnet.

As current increases, energy is added to the magnetic field. As current decreases, the magnetic energy returns to the electric circuit. Since the energy in the field depends on the current, both are locked in step.

The mechanical counterpart of inductance is inertia in a flywheel. When the flywheel is still, there is no stored energy in it. As we apply pressure to the crank and the wheel starts to turn, part of the applied energy is used in driving the belt and part is stored in the moving mass of the flywheel. In the same way, part of the electric energy is stored in the magnetic field when current flows in the inductance. The faster the wheel is turned the more energy will be stored, just as increased current stores more magnetic energy.

As the application of energy stops, the energy stored in the flywheel keeps the wheel turning. The flywheel energy is released to do work, just as the stored energy in the magnetic field can be released for work.

Although there is a magnetic field surrounding every wire carrying current, we may increase the inductance effect, when desired, in two ways:

1. We can wind the wire into a coil of closely spaced turns so that the magnetic fields will overlap and their strengths will be added. The field strength will then be proportional to the current in amperes multiplied by the number of turns in the wire.

2. In place of air for our magnetic path we can use "permeable" materials. For example, in iron an ampere of current can store about a thousand times as much magnetic energy as in air. Therefore, when we want maximum inductance, as in motor fields, transformers, inductors, and the like, we use iron magnetic paths.

Returning to our flywheel analogy, the rate of rise of the flywheel speed is proportional to the pressure applied to the crank. Likewise, in an inductance the rate of current rise depends on the electrical pressure,

After the power source is no longer supplying the energy, the stored energy in the magnetic field is sufficient to keep current flowing through the load circuit. For example, if an attempt is made to open suddenly a circuit which includes a large inductance, such as a dc motor field, the magnetic energy is quickly converted into electric energy—inducing the high voltage which forces the current as an arc across the open switch. In order to have the magnetic energy returned more slowly we must provide a discharge path of low resistance through which the current may flow at low induced voltage.

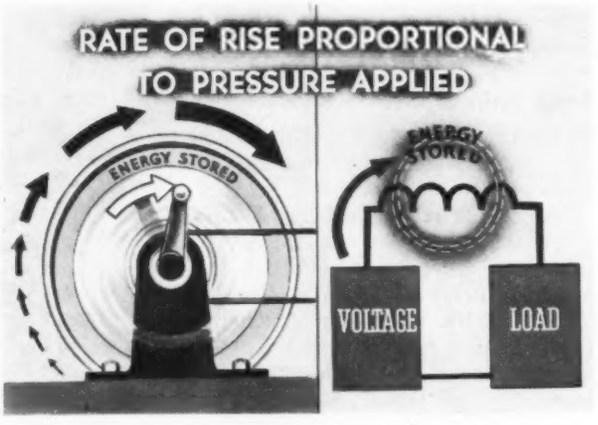
Thus we can say that in an inductance, the rate of change of the current (and the field) is directly proportional to the voltage across the inductance. When voltage is applied, the current and field strength rise. When current and field strength decrease, a voltage is induced in the electric circuit. This is the second law of inductance.

The unit by which we measure inductance is called the henry. In an inductance of one henry, the current increases at the rate of one ampere per second when one volt is applied. If, for example, to a theoretically perfect inductance of one henry we apply a steady voltage of one volt the current would continue to rise at the steady rate of one ampere each second, forever.

But practical inductances are not perfect. They are made of wire which has resistance. So, as the current rises, the energy to the inductance decreases as the energy to the resistance increases. Finally, the resistance loss consumes all the voltage and none remains to supply magnetic energy. Thus the current is held to a definite maximum.

Based on a sound slidefilm in the General Electric industrial electronics course.

The inductive effect may be compared to a flywheel where the stored energy is released after the input stops



In an inductance the rate of change in current is proportional to voltage

Practical Ideas

How One Large Repair Shop Dismantles Electric Motors

MICHAEL AXLER

Suburban electric railroads have to maintain electro-mechanical equipment which must perform under the severest operating conditions. Here is a time-tested method for motor overhaul worked out over many years, boiled down, we think, to perform a sequence of "tough" jobs about the easiest possible way. The information is passed on with the hope of helping someone else with similar problems.

Multiple-unit trains have traction cars and trailers operating more or less in pairs and each power car usually has four motors, two on each truck. When the car is shopped, one department removes the entire body from the trucks; another dismantles the trucks themselves for wheel and axle work, and we receive the motors for a complete overhaul.

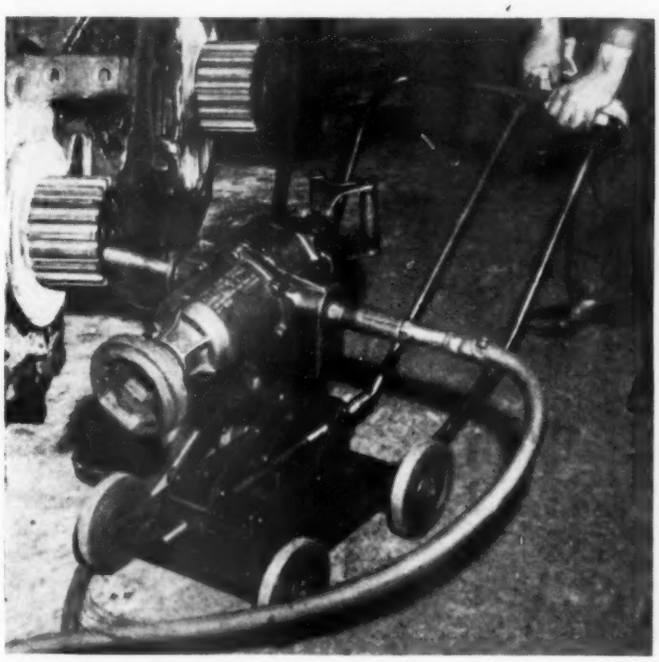
Removing the driving pinion

A tapered shrink fit made pinion removal difficult until we built a dolly with a pantagraph jack to get a big pneumatic wrench in position conveniently. Now the pinion comes off in a jiffy, in fact so rapidly that inertia is sufficient to keep the armature from turning.

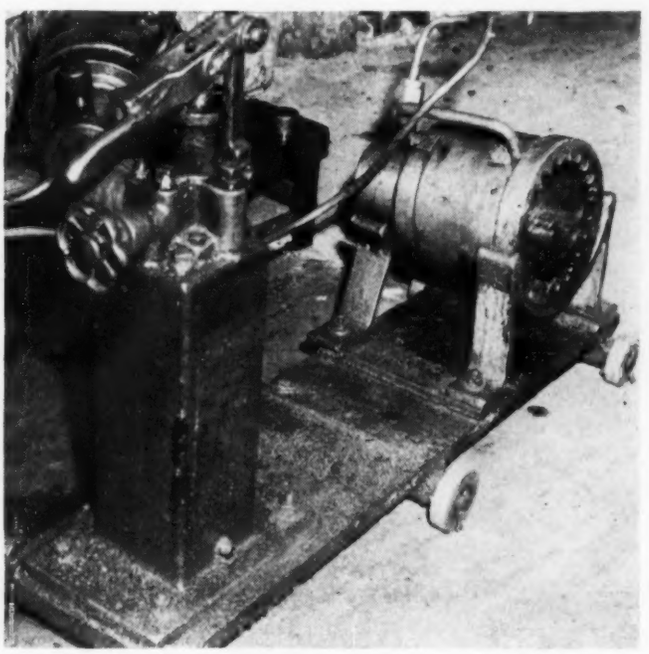
A dolly-mounted hydraulic puller slips over the pinion, meshing with the teeth as it goes on. When the splined end of the cylinder clears the inner pinion end, the puller is turned half a tooth so each of the internal splines will bear on a pinion tooth. A small hand pump connected to the hydraulic cylinder drives the piston against the armature and the splined cylinder pulls the pinion. The whole operation consumes about two minutes. Before the development of this dolly with its hydraulic puller unit, the pinion was surrounded with *a special ring*-type gas burner and heated evenly for about ¾ hr. until it expanded enough to be driven off with opposing wedges driven in by two men and two sledge hammers.

Removing the armature

The monorail crane next delivers the motor to a shop-built assembling and dismantling machine consisting of ways, carriage and two centers. The housing is laid on the carriage and adjusting screws position the motor to align the armature shaft with the centers. Both center-brackets are fixed; one of the centers is also fixed and extends enough to permit the

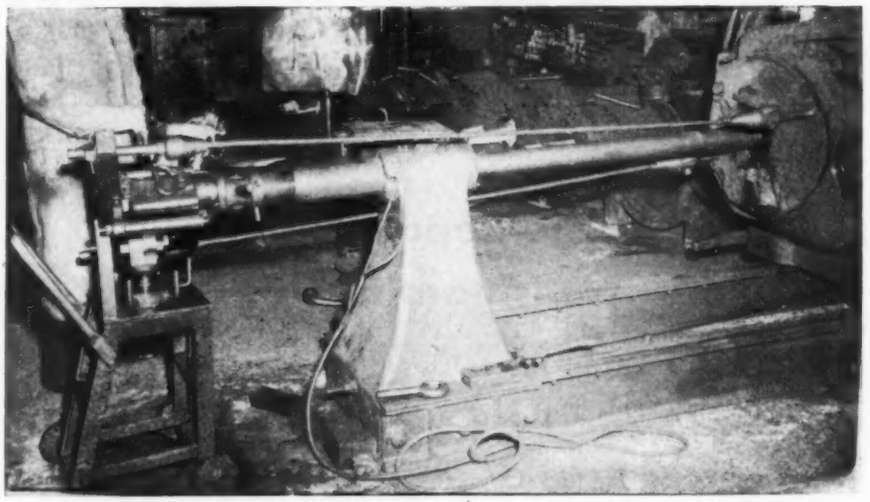


A pneumatic impact wrench mounted on a universal pantagraph dolly is here being wheeled into position to perform the first step in motor disassembly, removing the locknut. Armature inertia is sufficient to obviate blocking and the nut comes off in one or two seconds

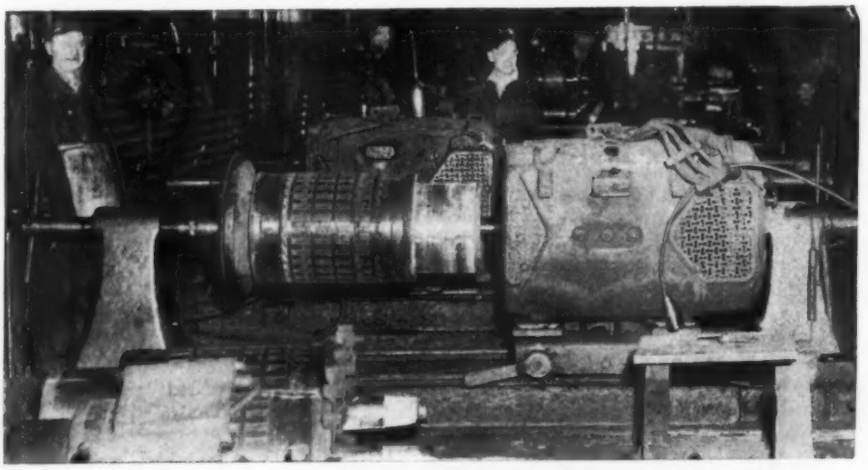


Next, a hydraulic puller is slipped over the pinion and turned so the teeth on the sleeve will bear against the inside of the pinion teeth. Pressure from the hand pump drives a plunger against the armature and the pinion is freed easily without resort to preheating

whole motor housing to slip over it; the other center is short and adjustable; both centers are smaller in diameter than the armature shaft. After the armature is fastened between centers, the end bells are removed by unscrewing the bolts with a pneumatic impact wrench, and pulling them with another hydraulic jack mounted on the end of one center. The piston carries a yoke which delivers the pull through two cables, equalized with the screws in the yoke, to eyebolts temporarily screwed into the end bell. Now, the carriage and housing are moved over the long center, exposing the armature so a canvas-strap-sling can pick it off the centers and transfer it to the cleaning cabinet.



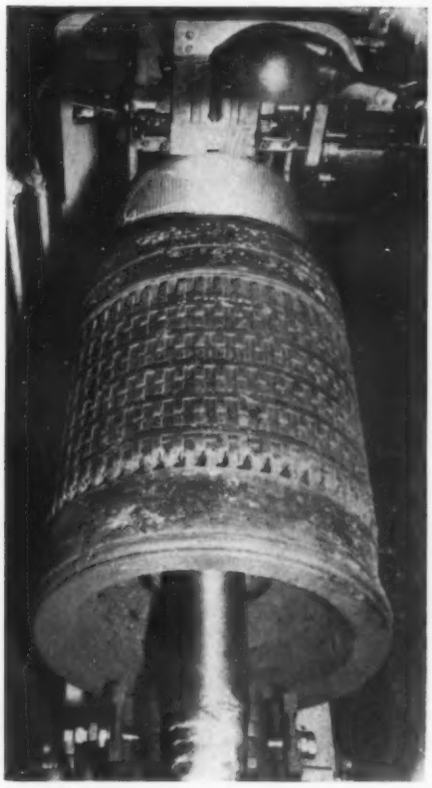
A hydraulic puller is rolled into position against the long center and the two equalized cables are bolted into the end bell for quick removal



With both end bells removed, the carriage is traversed under the long center exposing the entire armature so a traveling hoist can pick it up

Cleaning and mechanical servicing

After blowing armature dirt away with an air blast at 100 psi, the armature is sent to a lathe for turning and polishing the commutator; mica dust is exhausted with a special hood. Next, the mica is undercut with a "radial" saw having adjustable V-roller rests to hold and align the armature. Replacing the wire banding, repainting and baking complete the work on the armature except when there is major damage of any kind. Bearings are pressed out of the end bells and new ones are pressed in; these operations require turning the heavy end bells upside down and back so a trunnion faceplate was devised for the purpose. Finally, the newly babbitted bearings are bored to size in a horizontal boring mill. The only operation normally required on the motor frame is degreasing, whereupon the parts are ready for reassembly.



Heavy armature in position on the mica undercutting machine. The saw moves longitudinally on roller guides and has a screw vertical feed

Tangent-Method Leveling Plate For Compound Angles

JOHN BARKER

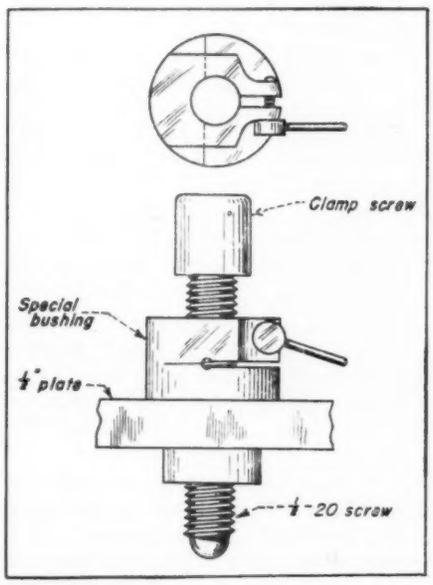
The layout problem of setting up and checking angles in two vertical, mutually perpendicular planes has had me thinking for some time. Finally, this tool was designed. Basically, it is a square plate (and I mean square!) 5 in. between the corner locations, with a fixed foot at one corner and adjustable vertical screws at the other three. The base of each right triangle, thus, is always 5 in. and the vertical screw adjusts the other leg while the hypotenuse is on the work or the surface plate, so the angular function measured becomes the tangent instead of the sine, hence the name.

Before going into constructional details too much, let's consider some of the ways the plate can be used. Any plane-angle can be set in advance, setting two screws to the tangent value of the side angles and then bringing the third screw up until the

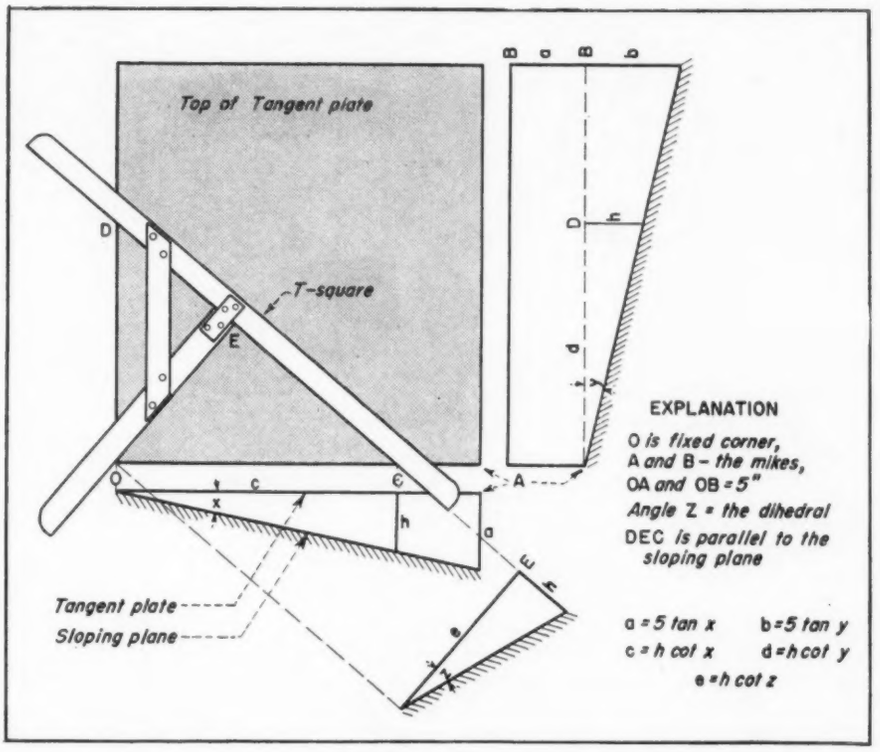
plate rests on four points. A surface angle can be checked by placing the work on a surface plate and adjusting the leveling plate until it is parallel with the surface plate, indicating with a comparator or height gage. A shaper table can be checked in similar fashion with a dial indicator in the arbor. The dihedral angle and the line of intersection between any two surfaces can be located and the horizontal angle between these lines or vertical planes and any other vertical surface determined also. All that's necessary is to look up the cotangent of the two bounding angles, (The cotangent is the reciprocal of the tangent.) and lay off these distances on the respective edges away from the low corner. Connecting the two points, which are at the same height from the base, establishes the line in the sloping plane parallel to the line of intersection between this sloping plane and the surface plate. The shortest distance from the low corner to this line (the perpendicular) will then be the cotangent of the dihedral angle.

Maybe these incidental facts are merely curiosities as most compound angles are given in terms of two coordinates anyway but some jobs can be speeded up with this knowledge.

Construction: In one corner of the plate is mounted the fixed foot. This can be a commercial spherical pointed screw-in dowel, ground to a good finish. It, like the three adjustable feet must be accurately concentric and



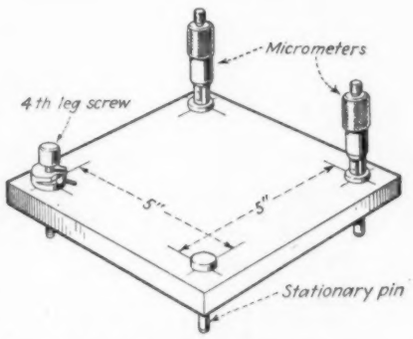
Spherical-pointed screw with precision clamp levels fourth corner



Diagrammatical representation of the tangent plate explains the measurements actually obtained although two micrometers take the only readings

perpendicular. One adjacent corner and the opposite corner have micrometers, adjusted to read zero when their spherical-pointed spindles extend to match the fixed foot. The other adjacent corner doesn't require a micrometer unless its desired as a check for accuracy, so a clamping screw like the one shown is fitted. (If mikes are unavailable, equally good work can be done wih three such screws using a height gage for the measurements, but the work will be slower.) Because mikes have only 1 in. travel the scope is limited but this can be rectified by adding slip-on 1-in. extensions to make up any length.

Another device or accessory for the plate is a special steel square to check the dihedral angles. The advantage of using this square is that it locates the desired point on the plate in one step, eliminating geometrical construction of perpendiculars or trial and error methods. To determine the actual angle of slope of any surface, regardless of what kind of boundaries it may have, place the work on a surface plate and level the tangent plate using a height gage. Without bothering to transfer the micrometer readings (tangents) into degrees and minutes, merely lay off the numerical value of these readings in any units, on the side of the square 90° from the angle measured. Starting from the fixed corner, then, the adjacent sides should be marked with the adjacent mike reading on the other leg and the diagonally opposite mike



The plate itself is an accurate square with four precision-bored holes

reading on the leg measuring the first angle. This switching automatically produces cotangents and eliminate the necessity for looking them up. Next, slide the T-square head between these two points until the arm lines up with the fixed corner. The distance along the arm from the corner to the head in the same units is the cotangent of the slope and, of course, in the direction of slope.

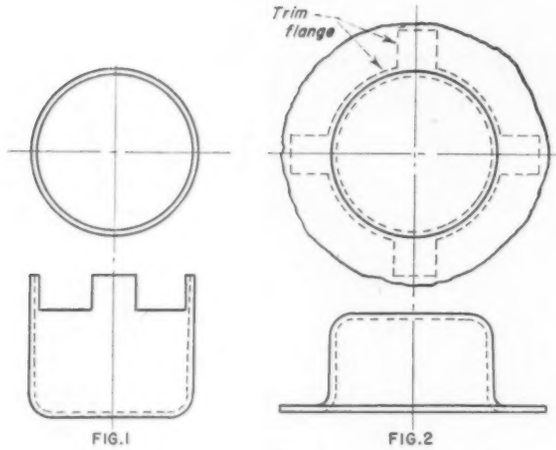
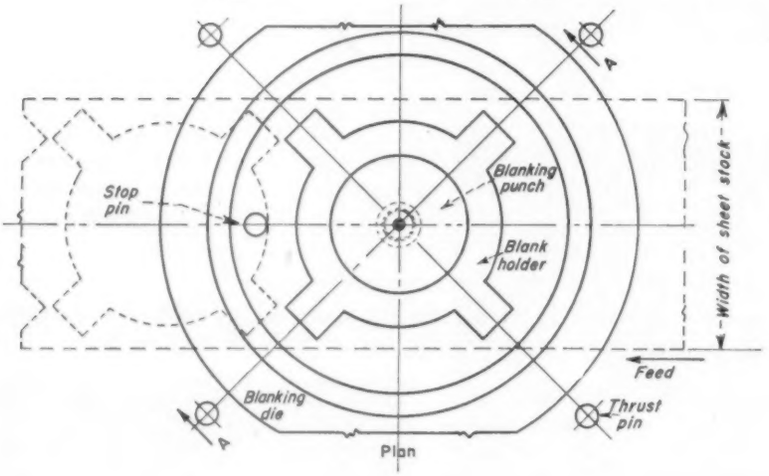
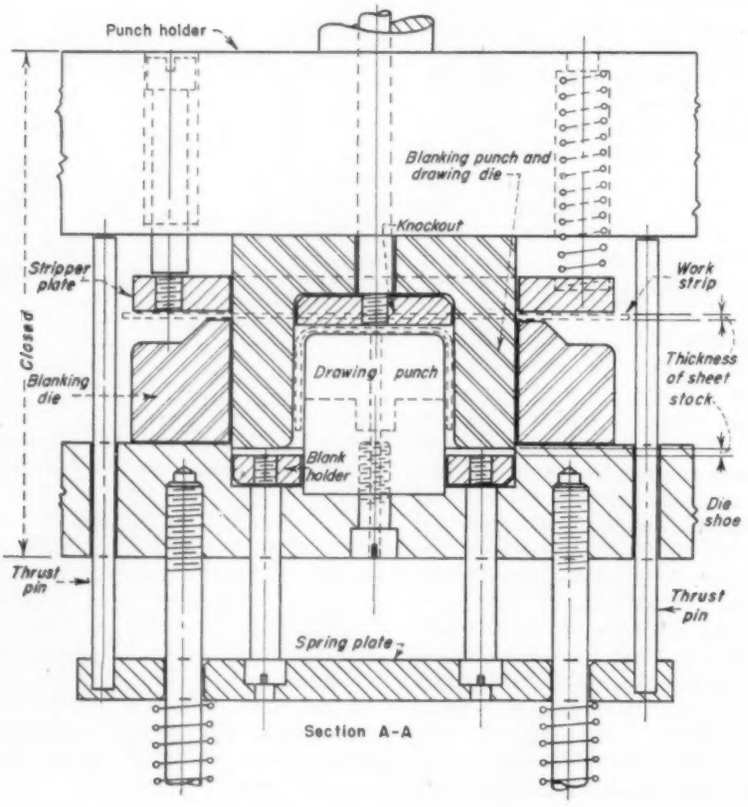


FIG.1 FIG.2



Plan



Section A-A

Drawing Pronged Shells

C. W. HINMAN,
Designing Engineer

Simple attachment gives uniform blank-holding pressure and even draw on shells with no distortion

Drawing light-gage metal shells with evenly cut prongs around their tops generally requires three operations: first, drawing the shell with a flange; next, trimming the prongs in the flange; then pushing the trimmed shell through the original drawing die to straighten out the prongs.

A simple attachment on any combination blanking and drawing die, however, allows the shell to be drawn evenly and in one operation. The attachment, by relieving the spring pressure between the faces of the drawing die and blank holder, not only reduces the power required to draw the shell but also enables it to be drawn with evenly cut prongs and without distortion around the top edges.

As the press ram descends, the blank is first cut and then drawn over the drawing punch by the combination blanking punch and drawing die. Near the beginning of the down stroke, however, the face of the punch holder contacts the upper ends of four thrust pins. Depressing these pins lowers the spring plate and controls the position of the blank holder. As the punch holder descends, the distance between the face of the drawing die and the blank holder is maintained equal to the thickness of the sheet stock.

The metal, therefore, is allowed to flow under the die face, free of the usual high spring pressure that would distort the prongs and produce uneven cut edges around the top of the shell. By changing the lengths of the thrust pins, the blank-holding pressure can be increased or decreased to suit conditions of the material being drawn.

Fig. 1—The part is a light metal shell with evenly cut prongs around the top
Fig. 2—Usual practice takes three steps: drawing, trimming, then pushing through the die again to straighten out the prongs
Fig. 3—Four thrust pins, spring plate and long screws pull the blank holder down with the punch with constant stock clamping pressure. Stock is blanked (where the work is shown dotted) and then the remainder of the stroke draws and finishes the part

Oversize T-Bolt—Discussion

JAMES WILSON

I was interested in Mr. Goldberg's piece on the elongated T-bolts in a recent *Practical Ideas* section and did some research myself with the hope of carrying the suggestion a little further.

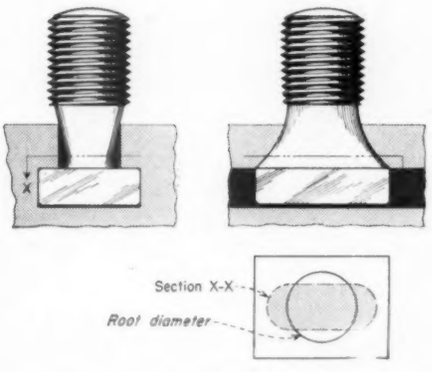
The bolt I have designed is a sample and was planned to suit the standard ½-in. T-slots accepted by the National Machine Tool Builders' Association.

Using Mr. Goldberg's idea, this design starts from the beginning, in the effort to make as compact a bolt as possible, and one which is as efficient as it is practicable to make.

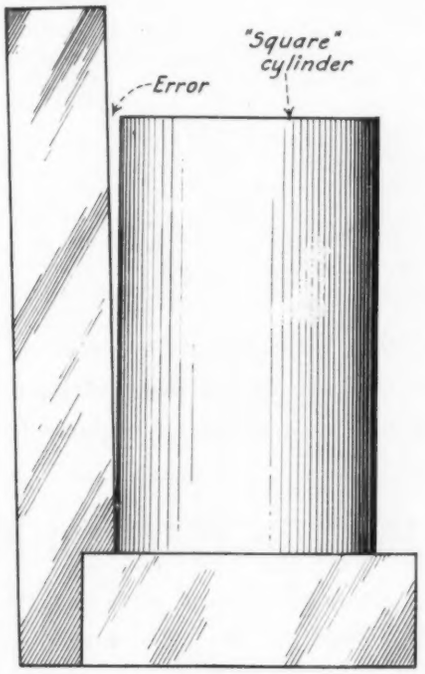
Sharp corners mean stress-concentrations; as the purpose here is to make a bolt which is equally strong everywhere—which should theoretically fail everywhere at once when the limit is reached—no short cuts to easier machining that would sacrifice strength have been tolerated. But it would not be difficult to set up a machine to produce these parts in quantity in a variety of ways and, for a few, they can be roughed out by machine and hand-finished without much more work than a simple bolt.

A machine table built for ½-in. T-bolts has slots which are 9/16 in. wide. A national coarse screw ¾ in. in diameter with 10 threads per inch has a root diameter of 0.004 in. under ⅝ in. It is then only a matter of elongating the neck slightly to maintain the area while narrowing it enough to fit the 9/16-in. slot. This has been done in a smooth curve all the way so there is no sharp break at the head itself and no one place where tension or torsion stresses are likely to be high. The increased size should produce a bolt which is roughly twice as strong (by the ratio of areas) as the standard ½-in. bolt and a few of these should find a welcome place for those special jobs.

Of course, an obvious objection might be raised that machine T-slots aren't strong enough themselves to withstand this extra strain. To that I will agree partially. However, if the surface area around the hole in the work is large enough, the stress on the T-slot will be pure compression, with no danger of bending the flanges of the slot.



Rounding all transition surfaces makes a more compact oversize T-bolt and gives uniform stress-distribution



A smoothly turned cylinder with flat or slightly concave ends makes an accurate square-checking gage

Discussions On Testing A Square

F. M. A'HEARN

The item by S. Framurz of Bombay, India, which appeared recently in "Practical Ideas" brings to mind a method I used 50 years ago when I was an apprentice.

A piece of stock turned on centers to a uniform diameter, and with faced end, or a piece of chucked material turned and end-faced furnished the test block.

With the square applied to the turned piece, as shown, the error is detected easily.

After corrections are made on the inner surfaces of the square, the opposite sides, by use of micrometers or calipers are made parallel with the corrected sides. To check side error of the blade, a line scribed with a tool held in the tool post gives a reference.

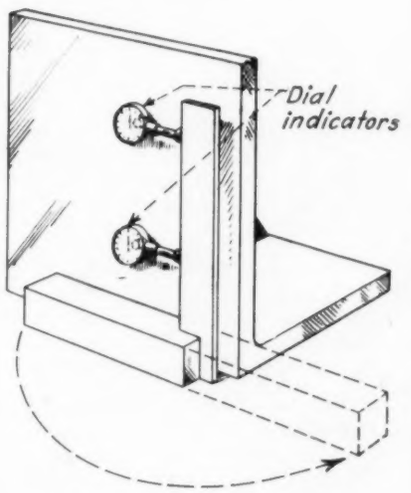
FAY E. CLARKE

A simple and positive method of testing the accuracy of a square without any special equipment is shown in the accompanying sketch.

All that is required is a surface plate, or a table with a flat top, and a piece of ordinary angle iron.

Mount two dial indicators on the angle iron so that one will contact the edge of the square blade near the top and the other near the bottom when the square is placed against the angle bracket. Now set dials at zero on both indicators. Next, without moving either indicator, reverse the square and set it so the indicators will contact the opposite edge of square blade, then move square until one indicator reads zero, the other indicator reading will show at a glance exactly double the amount of the error in the square.

Of course it is very evident that the blade on the square must be equal width at both ends in order to get the accurate test. But a square would be of very little use unless the edges of the blade were parallel.



Two dial indicators mounted approximately one above the other gage first the inside then the outside edge of the blade; micrometers check the parallelism of the two edges

Portable Pneumatic Machine Bores Locomotive Cylinders

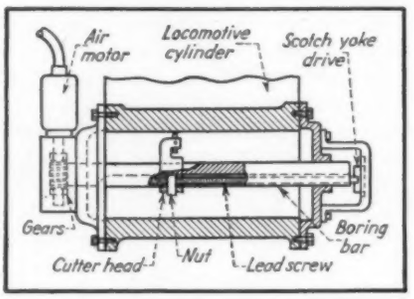
EDWARD KISKO

In keeping with the modern trend of taking machine tools to the work, here is a boring machine built to rebore locomotive cylinders and valve chests. Locomotive cylinders are often cast integral with the main frame so even the erecting shops need semi-portable tools to machine the castings. But repair shops have a tougher problem. There should be as little dismantling as possible, and in most cases, the work sequence should be arranged to perform several jobs on the locomotive simultaneously to save time and space in the shops.

The construction of this tool makes it easily portable and an air hose provides the only power connection. Various flanges and bolt circles make one tool adaptable to many cylinder sizes.

The boring bar has one deep longitudinal notch which serves two purposes: It carries the leadscrew within the outside diameter of the bar so the end bearings don't have to be oversize to accommodate a projecting screw and at the same time the overall size and weight are kept as low as possible.

The other function of the slot is to key the cutting head to the bar. This head has a square pin through it to fit the slot and threaded to take the leadscrew.



Leadscrew is held stationary while geared air motor turns and advances the cutter through the cylinder

Continuous uniform feed is obtained by holding the leadscrew while the boring bar revolves. This is accomplished by fixing a flat strap over the end of the boring bar and interposing a double sliding split coupling between the leadscrew and this bracket to allow for the eccentric motion. The end of the screw is widened and flattened and placed in the horizontal slot in the coupling on one face. The bracket, mounted vertically, guides the other face. Although the axis of the screw is traveling in a circle, it does not turn itself, and one revolution of the boring bar will advance the cutter one thread. Another system could be devised using a pinion on the leadscrew with a concentric ring gear to turn it.

In such large work, however, it's usually all right to advance the feed intermittently as the ridge produced is very slight and becomes negligible when compared to the cylinder bore, and there is one big advantage: Much finer feed can be obtained because the turns of the leadscrew can be split into several parts.

Uniform feed can be approximated by wrapping a chain fixed at one end over a sprocket on the leadscrew and inserting a tension spring between the other end and its anchor. With the pull always against the solid end of the chain the screw will oscillate slightly as it rolls in this spring belt with the effect that the cut will be a continuous smooth wavy line.

Your ideas may be useful to other shop men. We welcome contributions and pay for all material published in these pages which has been prepared exclusively for our use

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Fifth Selection: Lee Dodds' Non-Magnetic Angle Plate

Machining of Aluminum Alloys—III

Through the courtesy of the Reynolds Metals Company, portions of its forthcoming manual, "Machining the Aluminum Alloys," by L. E. Pennington, are presented in condensed form.

Milling Operations

RECENT developments indicate that with the design of new cutting tools and methods, speeds and feeds hitherto considered impossible may be employed in many milling operations on aluminum alloys. This is particularly true where the nature of the job warrants use of carbide-tipped cutters of somewhat special design at high spindle speeds.

For these high-speed operations, climb-cut milling is often employed to eliminate initial slippage between the cutter tooth and the work surface, which leads to work-hardening of the stock and excessive wear of the cutting edge. But vertical milling is preferred for better chip clearance when large surfaces are to be milled.

Tool Materials and Design

For conventional milling of aluminum, the cutters should generally have fewer teeth, ground to greater top and side rake, than normally used for milling steel. Coarse tooth, helical cutters, having smoothly finished tooth faces and cutting edges, perform well for most applications. Nicktooth cutters may be used where reduction in chip size is desired. When cutters with large helix angles are employed, it is often necessary to use two interlocking cutters of opposite helices to eliminate axial thrust.

If conditions permit their use, inserted-tooth cutters are recommended, since they facilitate the use of correct cutting angles and higher speeds. Face mills of this type should have teeth ground to considerable top and side rake. High-carbon steel cutters are satisfactory for short runs. High-speed steel—and carbide-tipped cutters for climb-cut milling—are recommended for extended production runs.

Carbide-tipped, inserted-tooth cutters are recommended for alloys of high silicon content, and are excellent for other alloys when their expense is justified.

Cutters should be beveled 3° to 45°, depending on the type of cut. Fine finishing cuts require the least bevel. The tooth should be ground with sufficient clearance, or relief, to permit free cutting action and to eliminate back drag and generation of excessive heat.

To a large extent, the optimum number of cutter teeth is determined by the type and depth of cut. Light finish cuts permit a greater number of teeth than heavy roughing cuts, where the power demand and chip volume per tooth engagement is much greater.

Cutters employed in high-speed climb-cut milling are generally of the same type as those used for conventional milling operations. They are usually designed with positive rake and helix angles. In some cases the teeth may be set on a negative helix angle and have no top rake. For work which is difficult to clamp securely to the machine, this type of cutter is particularly advantageous.

During the war, some work was done with negative-rake, carbide-tipped cutters for moderate-speed, climb-cut milling. This type of tool has the advantage of increased tooth life as compared to positive-rake cutters. Life ratios of 20 to 1 are reported in some instances. The stronger cutting edge better withstands impact of heavy cuts, permits removal of more metal per cut. But power demand is greater and the tool body and assembly must be stronger than required for positive-rake cutters. Cylindrical cutters, straddle mills, face cutters and end mills should conform to the above recommendations.

Recommended Practices for Milling Aluminum

High-Speed Steel Cutters			Cemented-Carbide Tipped Cutters		
Tool Details					
Cutting angle		48° to 67°	Cutting angle		68° to 97°
Top rake		20° to 35°	Top rake		—10° to 15°
Clearance:			Clearance:		
Primary		3° to 7°	Primary		3° to 7°
Secondary		7° to 12°	Secondary		7° to 12°
Helix		10° to 50°	Helix		—10° to 20°
Tooth spacing		Coarse	Tooth spacing. Approx. one tooth/in. diam. or fewer.		
Roughing Operations					
Cut/in.	Sfpm.	Feed: ft./min.	Cut/in.	Sfpm.	Feed: ft./min.*
Soft Alloy			Soft Alloy		
Up to ¼	700 to 2000	Up to 10	Up to 0.300	3000 to 15000	Up to 20
Hard Alloy			Hard Alloy		
Up to 0.200	500 to 1500	Up to 10	Up to ¼	3000 to 15000	Up to 20
Finishing Operations					
Soft Alloy			Soft Alloy		
Up to 0.020	Up to 5000	Up to 10	Up to 0.020	3000 to 15000	Up to 20
Hard Alloy			Hard Alloy		
Up to 0.020	Up to 4000	Up to 10	Up to 0.020	3000 to 15000	Up to 20

*Feed per tooth: high-speed steel cutters, 0.005 to 0.025 in. carbide-tipped cutters, 0.004 to 0.020 in.

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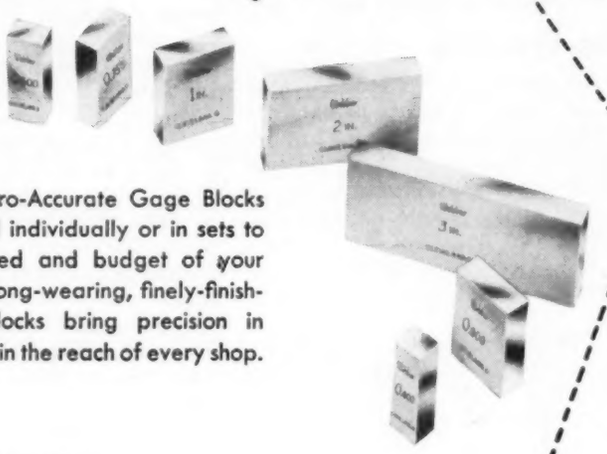

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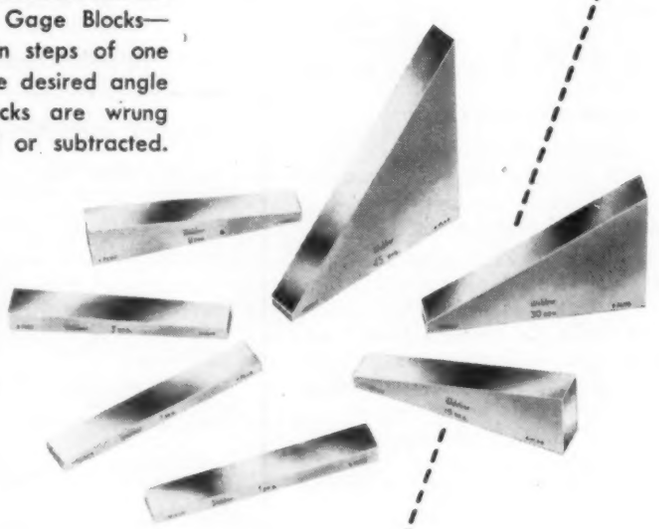
370,800 angles are possible with the new Webber Angle Gage Blocks—0 to 103 degrees in steps of one second of an arc. The desired angle is formed when blocks are wrung together and added or subtracted.



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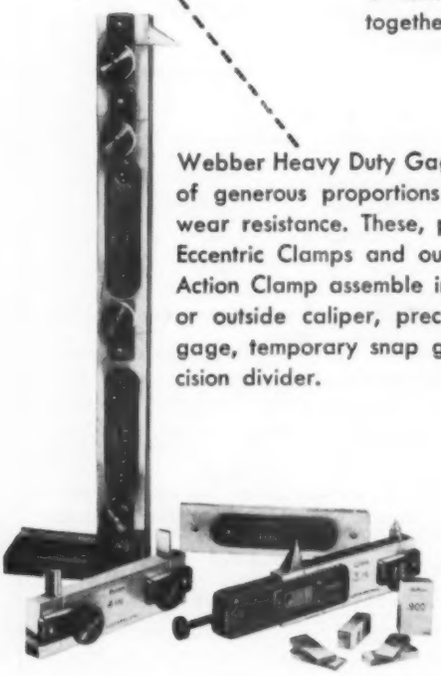

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Machining of Aluminum Alloys—IV

Cuts, Speeds and Feeds

Milling operations on aluminum alloys should be performed at high cutter speeds. Below certain peripheral speeds, the cutters show a tendency toward gumming and loading, but usually clear as speed is increased. Cutter speeds in many cases are limited only by the equipment available. In general, plain carbon-steel tools are operated at speeds up to 600 sfpm., high-speed steel cutters considerably higher, while a carbide-tipped tool will usually perform satisfactorily at the maximum efficient speed of the machine. In some applications, the latter have been used at speeds up to 19,000 sfpm. with moderate to rapid traverse rates and relatively light cuts.

Coolants and Cutting Compounds

Cutting compounds should combine the properties of cooling and lubrication. They should be supplied copiously to the tool and work under pressure, preferably as an atomized spray. In the case of carbide-tipped cutters, it is important that the coolant be supplied uniformly and consistently to all parts of the tool to avoid rapid expansion and contraction of the carbide.

Soluble-oil emulsions of 1 part to 15 are recommended for high speeds and 1 to 30 for lower speeds. Paraffin-turpentine mixtures, with or without machine-oil additions, have been recommended by some authorities.

Sawing Operations

Since circular sawing is essentially a milling operation, many of the factors governing the design of milling cutters are equally applicable to saw design. The teeth should be coarsely spaced to provide ample chip space and gullets should be generously radiused and well polished.

The high speeds recommended for sawing aluminum alloys require a sturdy machine. Excessive vibration causes imperfect, uneven cuts and decreased saw life. For most of the circular-saw designs, a positive feed is necessary. The top rakes incorporated in tooth designs give them a tendency to feed themselves into the work. For the same reason it is essential that the work be rigidly clamped. Circular saws are usually recommended for sawing heavy sections, where they produce cleaner, straighter cuts than do bandsaws.

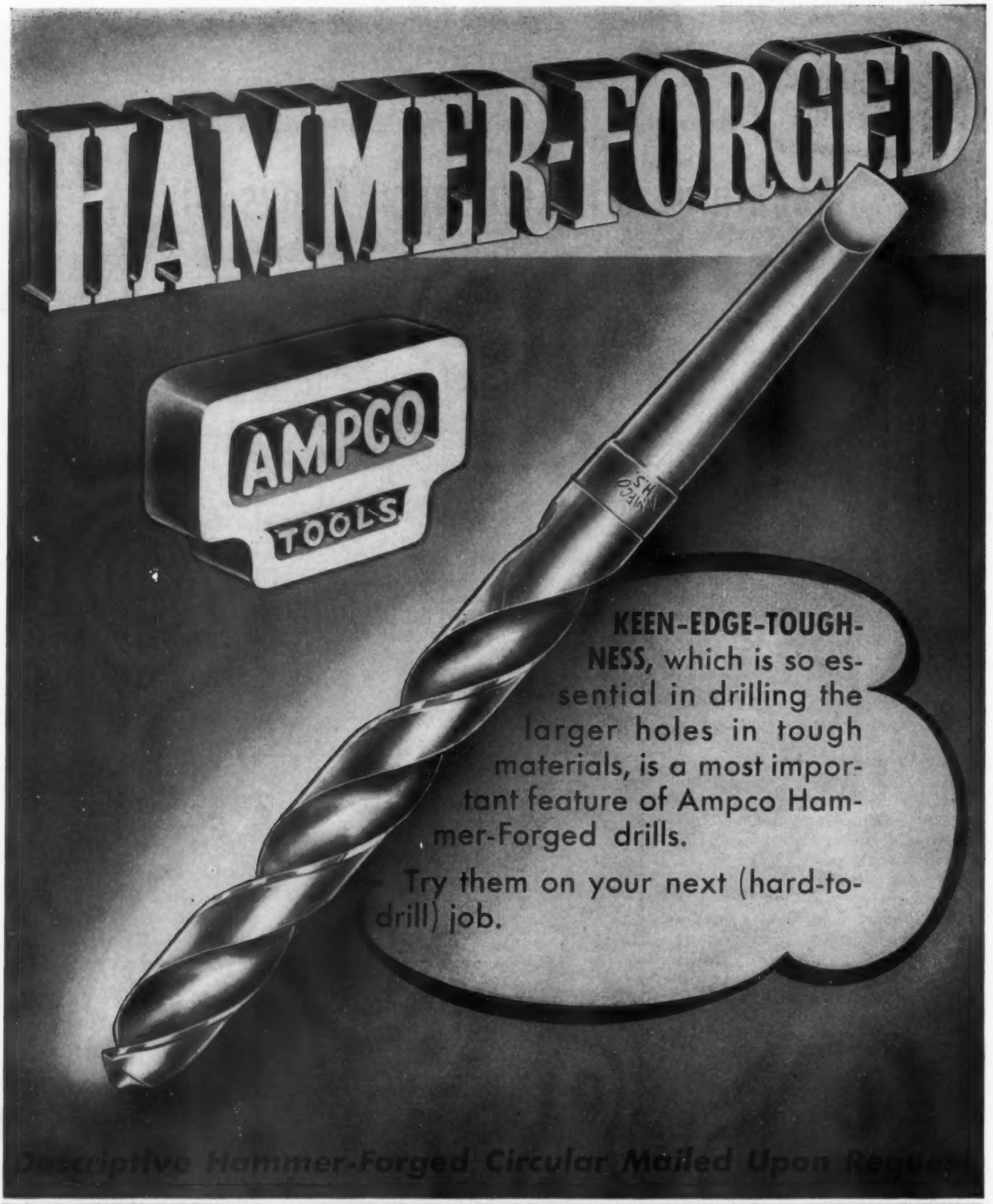
(*To be continued in an early number*)

Table II—Recommendations for Sawing Aluminum

TOOL MAT'L	FEED CONTROL	RECOMMENDED TOOL ANGLES AND CONTOURS PRACTICES						Speed ft./min.	Feed in./min
		Cutting Angle	Top Rake	Clearance Angles: Prim.	Clearance Angles: Second.	Clearance Angles: Side	Side Rake		
Circular Saws									
High Speed Steel	Hand	69° to 79°	5° to 12°	6° to 9°	25° to 35°	1° to 2°	0° to 15°	2,000 to 7,000	Hard alloys—4 to 17 Soft alloys—17 to 24
	Power	61° to 74°	10° to 20°						
Carbide Tipped	Hand	76° to 83°	1° to 5°	6° to 9°	25° to 35°	1° to 2°	0° to 10°	10,000 to 15,000	
	Power	71° to 79°	5° to 10°						
Bandsaws									
Spring temper steel or hard tooth, flexible back	Hand	72° to 80°	5° to 10°	5° to 8°	30° to 40°		About 5° to 15°	Heavy work—Up to 2500 General—4000 to 5500 Thin stock—Up to 7500	2 to 24
	Power	62° to 75°	10° to 20°						
Hacksaws									
Hard tooth, flexible back	Hand or Power	55° to 75°	10° to 25°	5° to 10°	30° to 40°				

Tooth Spacing	Set
Circular Saws:	
Coarse—Generally 2 or 3 teeth should be engaged in cut at all times.	Alternate set or chip-breaker teeth
Bandsaws:	
Heavy work—4 to 5 per in.	
General—Up to 7 per in.	Alternate set
Thin stock—Up to 11 per in.	
Hacksaws:	
Hand—10 to 15 per in.	Wavy set or alternate set
Power— 5 to 10 per in.	

HAMMER-FORGED



KEEN-EDGE-TOUGHNESS, which is so essential in drilling the larger holes in tough materials, is a most important feature of Ampco Hammer-Forged drills.

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NEWS OF METALWORKING

Survey of Tool Builders Shows May Orders Down; Shipments Hold Firm

CLEVELAND—May machine tool orders are expected to drop about 30%, according to a check by *American Machinist* of leading builders in this area. The decline in domestic business is largely attributed to the wave of strikes which has paralyzed major industries over recent months. However, the industry is keenly disappointed in a similar sharp decline in foreign orders. Despite this, shipments are expected to hold up remarkably well, since labor conditions within the industry are reported fair at this time.

With reference to foreign orders, French interests have been active in recent months, and Sweden has also been a good customer. Some spotty orders have been received from Italy and China, and inquiries are now being received from Australia for special tools.

One reason assigned for the lack of large orders from Russia is that the Russians are not going to buy anything beyond their barest necessities until they see the amount of loot they can get from the defeated areas of Europe and Asia. When the inventory of this material has been completed, then Russia can be expected to start negotiations for needed items.

Substitutes Being Used

Meanwhile, machine tool builders are producing as best they can under extremely discouraging circumstances. Lack of materials and supplies have forced the use of substitutions which, in the majority of cases, has meant added costs for the builders. Scarcity of items—motors for instance—has caused many a manufacturer to store a finished machine, oftentimes for weeks, until the needed part could be secured and shipment made to customer.

Surplus Motors Available?

One machine tool builder claims the motor shortage could be greatly eased if the federal agencies would turn loose motors they have stored.

Electrical motor builders, with fire being leveled at them, are being brought to a stop by the current strike within the copper industry. The largest motor builders in the Cleveland area have been operating for weeks on a hand-to-mouth basis, because of the copper shortage using every facility at their command to lay their hands on copper, no matter what the shape, since they were willing to rework it in their own shops to make it conform to their needs.

Schedules Upset

With all of the confusion it is little wonder that delivery schedules are, on the whole, not being met. Where the securing of a casting for a standard machine formerly required as much as two weeks, machine tool builders now find that as much as four to six weeks are required provided, of course, the builder is lucky enough to find a foundryman willing to even book his order.

One far-sighted builder is the exception to the general rule. He, seeing the days of shortage ahead when the steel strike materialized, promptly shut his plant down tight without using up his inventory of steel, bearings, and other parts. When steel became available, following the end of the strike, he reopened on full schedule and today is one of the few machine builders able to work his plant a full three shifts per day and six days per week.

Because of the uncertainty in securing materials and parts going into the manufacture of machine tools, practically all of the builders have given up, at least for the present, their previously announced plans for restoring to their present lines those tools which they were forced to discontinue during the war years.

Letting Customers Help

One builder, now producing special machine tools almost exclusively, claims that his company's return to the full line of standard tools turned out before the war is still months away, that he will not commit his company to turning out a full line of his standard tools until he sees a decided change for the better in the supply of castings, bearings, steel and electrical parts. At present he is operating with his full force of workmen and forcing the buyer to assume at least part of the responsibility for securing the necessary supplies.

Little Order Duplication

A cheery note for machine tool builders is the fact that there is little evidence of a duplication of orders by buyers. Manufacturers feel that such a duplication would have showed up in order cancellations before this date and there is no indication of this at this time. On the whole, relatively few order cancellations are being received, even from the automotive industry. On the other hand, the automobile builders are continuing to place orders in sizable volume with some evidence being shown that the railroads can be expected to get into a machine tool buying frame of mind in the not too distant future.

Peacetime Plane Production—These fuselages are on the assembly line at the Commonwealth Aircraft Plant, Valley Stream, L. I. Daily production of 10 of these civilian planes, dubbed "Skyrangers," has been increased to a rate assuring annual output of some 5,000 units

Gaging Business

Production Flow Uneven

American industry is still badly disrupted by the imbalance of parts and materials caused by strikes, OPA price ceilings, and the general adjustment of sales markets to offset rising costs. Uneven profit margins afforded by OPA price ceilings leave many companies no option but to stop producing certain items and concentrate on more profitable ones, if they are not to show losses. This has also forced companies to stop shipments to distant market to cut down on selling costs involved and to enable them to take better care of nearby companies.

These factors, plus continuing pressure for deliveries by hard-pressed customers and strike-interrupted operations, have caused the upsetment of many industrial relationships. Towering backlogs against a trickle of production have forced manufacturers from coast-to-coast to turn down business in order to do a more effective job for a smaller number of customers.

This trend has now reached its most serious point. Metalworking plants across the country find their operations interrupted by lack of some part or other or inadequate supplies of certain materials. In many cases, customers are willing to accept delivery of incompleted industrial equipment or parts, in the hope that they can locate the missing parts or finish the necessary work themselves. In other cases, suppliers are asking their customers to get out and help them secure hard-to-get materials and items. Steel producers are asking customers to ship back scrap promptly to help maintain a high level of steel operations.

Recovery Will Be Slow

The recent wave of price increases granted by OPA to producers of equipment, nonferrous metals, and various industrial products, may not help to restore the industrial equilibrium quickly. The reason is that costs are still rising, and many industries will be hit by higher coal prices, metal prices, increased freight rates, and so on. This will bring a new wave of requests for price relief to OPA, and allowing for the usual OPA delays in taking action, further disruptions in industrial production may be expected.

As it is, it would take many months to restore the balanced flow of materials and parts once more. Steel mills, copper and brass mills, foundries and forge shops will have to work at top speed until late this year before adequate material will have been poured into the industrial pipeline to permit a semblance of balanced production. Whether or not they will be able to attain such levels of production depends upon cost and price developments, labor legislation, renewed wage demands by unions, and jurisdictional strike. The shape these factors will assume will determine near-term level of production.

Equipment Buying Trends

New England manufacturers, long rated behind other geographical areas in the relatively modern state of their equipment, are reported to be buying new equipment heavily. Realization of New England's poorer position in relation to other areas and the growing impact of rising costs have convinced many manufacturers in that area that modernization is the best step they can take in protecting themselves against future competition.

However, the construction of new plants in various areas has been notable in the installation of new special machines designed to reduce labor costs. This has accounted for some of the sustained volume that machine tool builders have enjoyed since the end of the war, despite the increased availability of surplus equipment. Although current orders have slackened, probably due to unsettled industrial conditions, the volume of business is still well above what many in the industry had expected.

Some of the new business is reported to be placed by small concerns, who are confidently expanding and who have not encountered the labor difficulties that large organizations have.

Dealer Sales of Surplus Tools Slumped Slightly in May

WASHINGTON—Dealer sales of surplus machine tools by two-week periods since January 1 are as follows:

	Sold for	Cost
May 1-15	$4,499,598	$8,966,200
Apr. 16-30	4,875,098	10,865,732
Apr. 1-15	5,288,476	10,471,875
Mar. 16-30	3,389,255	6,586,582
Mar. 1-15	3,490,756	7,454,127
Feb. 16-28	1,616,425	3,693,767
Feb. 1-15	1,633,516	3,398,383
Jan. 16-30	1,342,617	2,705,485
Jan, 1-15	338,791	775,674

The decline of sales in May was caused chiefly by passage of the Manasco bill, requiring the setting aside of stocks for preferences. Dealers seem to have misunderstood the measure and to have slacked off on their efforts.

Dealer sales of machine tools and production equipment through May 15 amounted to $25,526,957, which originally cost $53,788,819.

Aircraft-Styled Midget Trailers—Designed by former aircraft engineers, who applied aviation principles to create lightweight conveyances, these trailers are being produced on an assembly-line basis at the Kit Manufacturing Co., Norwalk, Cal. Frame of the vehicle is welded steel tubing, and torque bar suspension replaces springs and shock absorbers. The trailer accommodates two sleepers, and has a galley with a 25-lb. insulated icebox.

Six Million Cars Unlikely in 1947; Production Disrupted, Steel Short

DETROIT—Hopes are fading rapidly that the automobile industry can produce six million cars in 1947, even if no more labor difficulties should be encountered from now on. The truth is that continuing shortages of parts and materials will make it impossible to attain the desired goal. This is sadly acknowledged to be the fact by all automobile companies, though they will have the physical plant capacity and necessary equipment to produce that volume. The highest figure that any company believes the industry can rise to next year is somewhat under five million units. And that figure can be reached only if everything goes reasonably well, with a minimum of interruptions in the months ahead.

Steel supply will be the biggest problem next year. Sheet and strip steel in particular, which automobile companies use in huge quantities, will be short of the tonnage required for six million units. It is now believed that certain other shortages, such as textiles, will not prove too serious, because the primary limiting factor in production will be steel. Castings are expected to be in much greater supply then than now.

Prices Vs. Demand

If it were possible to overcome the materials and parts shortages, automotive executives feel that at least two six-million-car years lie ahead. Most of them admit, however, that if retail car prices should be advanced sharply, retail demand would be adversely affected. It always has been in the past and probably will be in the future. The industry looks for higher average yearly sales than prewar because the number of families in the United States is growing at the rate of one million a year. Heretofore car registrations have closely paralleled the number of families.

Chief trouble now is that strikes and shortages have so disrupted production that manufacturers are able to plan only a short time ahead. One company finds it impossible to set up schedules more than 14 days forward. Another has changed its production quotas ten times in eight weeks. Operations have been so irregular that it has been hard to measure efficiency. One important company says that its overall worker efficiency is below 70% of the prewar level. It expects improvement, however, as soon as its operations can be put on a continuous basis. A prominent car maker is encouraged by the steady increase in its manpower output since April 1. Most companies are hopeful that plant efficiency will eventually get back to the prewar standard.

Cost Cutting Equipment

One of the largest manufacturers thinks that there is only one way to get production costs down: to keep installing multiple-operation machine tools and other high-production equipment. An independent company, outside the Big Three ranks, does not expect to reduce its costs right away. It will wait to retool for new models, feeling that if it puts in new machine tools today, it could not get back the cost from the run on current models. An important parts maker is studying its manufacturing costs plant by plant, including cutting of materials-handling expenses. It is going on the theory that the higher the investment in equipment per worker, the greater the output.

Small Cars Unlikely

Though three companies are preparing to introduce so-called light cars, which will weigh at least 1000 lb. less than present models, there is no tendency on the part of old-established manufacturers to build midget cars. The older hands in the industry are convinced from experience that American car buyers want a full-sized, five-passenger automobile and will not be satisfied with anything less. Moreover, big companies poohpooh the rear-engine, front-wheel-drive car, emphasizing the disadvantages as against the advantages. They assert that changes in car design will be evolutionary rather than revolutionary. One of the main problems confronting most companies is whether to attempt to get the same power as now from a smaller engine or to get more power from the same size engine as today's.

Almost all automobile companies disclaim any intention to put 1947 models on the market later in the year. They say that today's cars, so far as they are concerned, are 1947 models. They are chary, however, in predicting the timing of introductions of new models during 1947. Many factors are to be considered, especially the competitive situation. One thing is sure: any models announced anytime during 1947 will be called 1948 models.

Wilson Heads General Motors in Sweeping Changes; Sloan Chairman

DETROIT—In sweeping changes of the staff of General Motors Corp. "to strengthen the general executive staff in view of its expanding responsibilities," Charles E. Wilson, president, emerged as chief executive officer. He succeeds Alfred P. Sloan, Jr., former chief executive officer, who continues as chairman, and was also elected chairman of the bonus and salary committee, formerly headed by Lammont du Pont. Mr. du Pont resigned as director to assume greater executive duties with the E. I. du Pont de Nemours & Co.

Donaldson Brown resigned as vice-chairman of directors, but will continue as a director and member of the finance committee. M. E. Coyle, former general manager of the Chevrolet Motors Division, was elected to the new post of third executive vice-president and will concentrate on general administration. Nicholas Dreystadt, general manager of the Cadillac division, was appointed general manager of the Chevrolet division, and John F. Gordon, chief engineer of the Cadillac division was made general manager.

Policy Committee Split-up

An important change in the reorganization was the division of the policy committee into two committees, one to deal with financial policy and the other to handle operations. Members of the existing policy committee were elected members of the financial policy committee, with the exception of O. E. Hunt, executive vice-president, named to serve on the operations policy committee.

New directors elected include R. K. Evans, vice-president of GM, and group executive of the general engine divisions, and Louis C. Goad, GM vice-president and group executive in charge at Dayton, O., the Delco Appliance division at Rochester, N. Y., and the Buick-Oldsmobile-Pontiac Assembly division at Rochester.

Bradley Heads Committee

Albert Bradley, executive vice-president, was named chairman of the financial policy committee with headquarters in N. Y. John L. Pratt, formerly a vice-president, and Fred G. Donner, vice-president in charge of finances, were elected to financial policy committee memberships.

Members of the operations policy committee include: Mr. Wilson, as chairman; T. P. Archer, Mr. Bradley, Harlow H. Curtice, Mr. Donner, Mr. Evans, Mr. Goad, Mr. Hunt and Mr. Coyle.

Material, Parts Shortage Hold Up West Coast Production, Expansion

SAN FRANCISCO — Material and parts shortages are still the main items holding up production in metalworking firms on the west coast. Anything improving or retarding supplies is watched carefully by plant operators, with some doing something about it directly.

O'Keefe and Merritt, the west's largest manufacturer of appliances, (refrigerators, stoves, etc.) early in June announced that 17 acres had recently been purchased in Los Angeles and that soon a sheet steel mill would be under construction. The mill will have a 50,000-ton-per-year capacity and will provide needed materials for its owners, as well as other firms, said to be co-sponsors of the project. Two 50-ton open hearth furnaces will supply steel to be rolled into sheet from 12 to 26 gauge, and 48 in. wide.

Aluminum Supply Uncertain

Kaiser's aluminum operations near Spokane, Wash., will be ready by July 15, and orders for aluminum sheet have been pouring in. How much aluminum will be for sale to manufacturers here is not known, as Kaiser has been off-again on-again in plans for using the light metal in his automobiles. Recent announcement by the company that steel was now being shipped east from Kaiser's Fontana mill to "midwest steel centers for processing into automobile sheet" would indicate that immediate plans are contrary to a former announcement that aluminum would be used in Kaiser-Frazer cars.

Also, contracts were let last week for start of construction on Columbia Steel Co's. $25,000,000 expansion at Pittsburg, Calif. There hot coils will be rolled into sheet and tin plate at a rate of about 500,000 tons a year. Operations are expected to begin late in the summer of 1947. If U. S. Steel, Columbia's parent, is given the Geneva mill, hot coils for the Pittsburg expansion will come from Utah instead of Alabama.

Broad Material Shortage

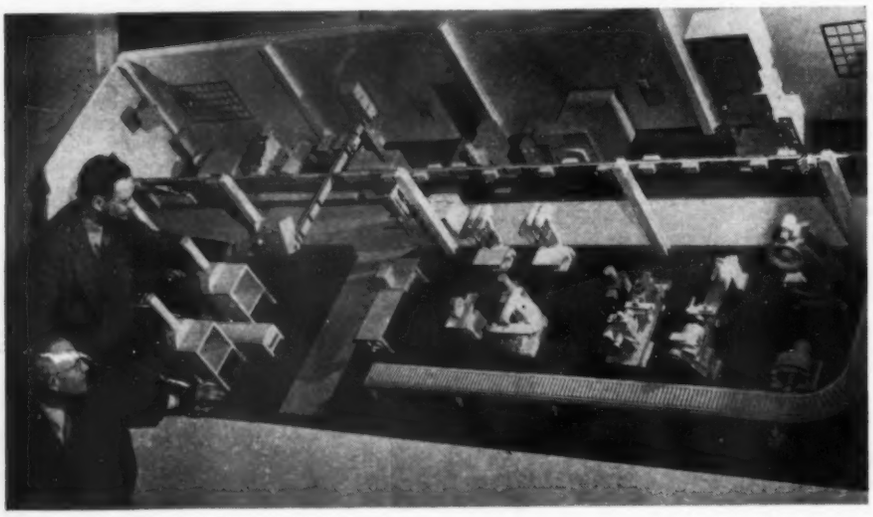
These announced future aids to western metal supplies are good news to coast machine shops, but of more immediate interest is news of eastern labor developments. Of 232 plants in the Los Angeles area, all (except shipyards and aircraft plants) are ready to increase personnel as soon as supplies and materials were available. Some relief is being felt by release of surplus property which is slowly being put on sale at various storage points on the coast. However, it's a lucky manufacturer who can find just the material he needs for a sustained operation.

Labor supply on the coast is good. Reports from shop-owners who have been meeting the skilled worker pinch by using apprentices show the practice working out to mutual satisfaction.

Shipping Strike to Hurt

The latest wrinkle to work its way into the operator's brow is the shipping strike, which will tie down water transportation on both coasts. Here again the American labor scene will make itself felt on west coast material supplies, as much of the heavy metal and equipment comes here through the Panama Canal. This will throw a secondary block on plant expansions. Lack of lumber, also, will shackle industrial expansion which is prevalent here now, as indicated by a recent monthly total announced for northern California, in which 147 small projects were started at a cost of $13,750,000. In the first three months of 1946 California had a record of 2,674 new corporations.

Typical of a west coast plant trying to get under way after having served its country during the war years is the Schlage Lock Co., San Francisco. Manufacturing builder's hardware, their efforts to get necessary raw materials allows them to produce at about 60% of capacity. Also, lack of parts for repairing machinery worn out since Dec. 7, 1941 is proving a hindrance. The company can't fill its domestic orders which are booked for the next four months' production.



Westinghouse Electric Exhibit of Power Aids to Tour Nation

NEW YORK—A new electrical exhibit which will soon tour the country was previewed before the Edison Electric Institute's conference at the Waldorf-Astoria Hotel on June 4th, under the guidance of C. B. Stainback, manager, Industrial Department, Westinghouse Electrical Corp. Color movies, vivid model dioramas and actual equipment were combined to demonstrate to production men the latest applications of electrical energy to industrial plants. (See photo.)

Foremost in importance is the need for adequate, and flexible, secondary power distribution. A scale model of a typical factory as it existed in 1939 is brought up to date before the eyes of the audience, first with a flexible, bus-duct system enabling any machine rearrangement to be made in a matter of minutes. Simple plug-in bimetallic circuit breakers (explained with a large working model) form the second step, which eliminates virtually all connection and terminal-insulation problems. Then, by adding compact capactors, it was demonstrated how the load-capacity of any existing systems can be greatly stepped-up.

Another large model explained the characteristics of a typical inductive load with a power factor of about 50% —illustrating how only half of the current actually moving in the lines produces power while the other half is purely reactive. This condition can be largely corrected with no additional operating cost, thereby releasing approximately 35% more line capacity for adding new machines.

Electronically-controlled resistance welders, radio-frequency induction heating and dielectric heating, infrared drying, mass production electric-furnace brazing, precipitrons and air handling and conditioning, and plant lighting were several of the phases clearly shown, with the applications and advantages pointed out.

Detroit Letter

Decentralization Stopped

The trend to decentralization of the manufacturing phases of the automotive industry has led to some talk that Detroit is on the wane as the center of the giant industry. But this is now dissipated.

Two recent moves insure the city of not only remaining the automotive capital of the world but give it a firmer grasp than ever. One came out of the General Motors meeting in New York which saw a shift in the administrative lineup of the corporation, with C. E. Wilson not only re-elected president but becoming chief executive officer.

Now with the wide powers of chief executive officer, Wilson brings the operations of the corporation back to Detroit.

Ford's Research Project

The second significant move was the announcement by Henry Ford II that the Ford Motor Co., would start as soon as possible on a $50,000,000 research laboratory project in memory of his late father, Edsel B. Ford, and in honor of his pioneer grandfather, Henry Ford. The research center will not only develop new ideas in manufacturing processes and engineering but will develop young Henry's pet ideas on "human engineering."

Add the Ford $50,000,000 project to the $20,000,000 which General Motors plans to spend on its technical center here and Detroit is certain of its hold not only on the production end of the industry but on the research and development side for long-range planning.

The elevation of Wilson to the real power within GM is significant. Although president since William S. Knudsen resigned just prior to the war, Wilson in Detroit has had to go to New York for some of the bigger decisions within the corporation. He was the second in command, despite his title, with Sloan as chairman of the corporation and chairman of the board sitting in New York.

Dreystadt Heads Chevrolet

Nicholas Dreystadt was shifted from Cadillac to Chevrolet to replace Coyle and John F. Gordon, chief engineer for Cadillac, becomes the new general manager of the division.

As Dreystadt took over, Chevrolet announced a new postwar production record for May. It made 58,820 cars and trucks last month, against 47,077 units in April. While only at about one-third of its capacity, the figure was encouraging in the face of the many difficulties that beset the industry last month, including the coal and rail strikes.

Ford Plants Reopening

Simultaneous with its announcement of the plans for the huge research center, Henry Ford II revealed plans to reopen the 14 assembly plants across the country before the end of the month. The Rouge plant, largest of the chain, was to open June 24 with manufacturing operations set for a week before. Canadian plants were to open June 10.

The reopening was still in the face of prospective difficulties in the path of continuous production. Albert Browning, director of purchases, stated that while the situation appeared improved over what it was when the plants shut on May 8, 42 of the principal suppliers were still on strike.

John S. Bugas, director of industrial relations, added that labor productivity, which was off 34 per cent from 1941 levels in January, appeared to be improving. But he was not too hopeful that the productivity would reach the 1941 state very soon.

Ford Blames Imbalance

Young Ford disclosed that if all factors were in balance, the company could be producing at the rate of 5,400 cars and trucks a day. But the best figure up to the time of closing was around 3,000 units. Ford disclosed that the closed plants were costing the company about a half million dollars a day to operate. And the company was still producing cars at a loss, despite recent OPA price increases.

"Not until three factors are achieved can we reach a breakeven point," young Ford stated. "They are increased labor productivity, sustained production and more equitable prices." The latter indicates that like the rest of the car producers, Ford is going back for higher tags on their cars.

Third Quarter to Gain

Approaching the start of the third quarter, passenger car producers are eyeing higher schedules.

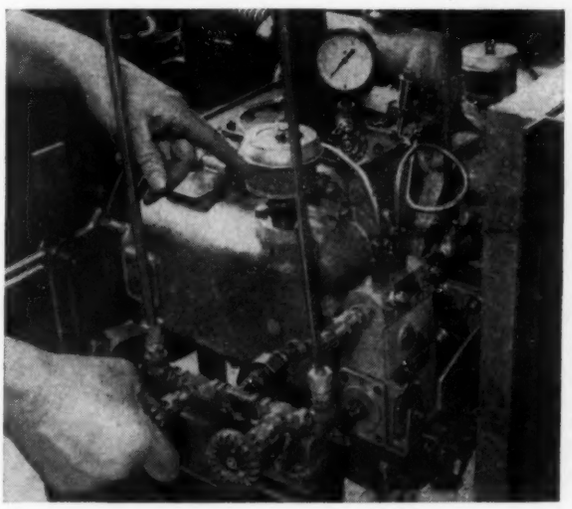
While barely averting general shutdowns during the trying period just passed, the manufacturers are becoming encouraged. Hudson has just raised its sights to 580 cars a day. Chrysler divisions while plagued by materials' shortages and suppliers' strikes are over the 3,000-car a day mark.

General Motors divisions are again producing at a fair rate. End of the strike in a principal supplier's plant is solving the spring wire shortage somewhat. Buick achieved 700 cars a day recently and is looking higher.

Others likewise are hopefully looking to new highs in July, unless something new comes along to block their plans.

RHEEM BUYS SURPLUS PLANT; EXPANDS OPERATION

HOUSTON, TEXAS—The Rheem Manufacturing Company has purchased the government-built unit operated by the firm during the war here, and plans for doubling the present plant capacity have been announced by R. S. Rheem, president. The building, with total floor space of about 180,000 square feet, cost in excess of $750,000. When the war ended the plant was manufacturing 4.2 inch mortar shells and several other munition items. Present plans call for taking down half the building and shipping it to Mexico City to house a new plant to be opened there. The rest will remain here to augment the original plant.



Valveless Motor — The new Hickey Motor, without valves, timing gear, cylinder head or carburetor, can produce slightly over 30 hp. Ports replace valves, and a fuel injection jet takes the place of the carburetor. Fuel may be either diesel oil, gasoline, or kerosene. The inventor is Henry J. Hickey, Cleveland automotive engineer.

Price Ceilings Lifted on Many Items; Pneumatic Tools, Pumps, Others Up

WASHINGTON — Manufacturers of portable pneumatic power driven tools have been given an interim increase of 12% in their ceiling prices by the OPA, effective June 1, 1946. Where sales are made by resellers, the increase in manufacturers' ceilings may be passed on. The OPA announced that the increase was granted to cover higher costs for materials and labor, pending completion of a survey to determine the specific price increase to which the industry is entitled.

Manufacturers of gears, pinions, sprockets and speed reducers were granted a 13% increase in their maximum prices, effective May 27th. The increase applied only to products made by manufacturers generally recognized as members of the gear industry. In addition, a special arrangement was made for manufacturers who produce or supply motors to which they add gears, inasmuch as such motors manufacturers had been granted a prior increase of 16½% for integral horsepower electric motors and 27% for fractional horsepower motors.

Wages, Materials Up

The OPA pointed out that approved wage increases amounting to 13% had been granted since Jan. 1, 1946 by manufacturers turning out about three-fourths of the industry's total output of motors. Moreover, the industry has faced a 9.8% increase in costs for steel and bronze forgings and castings. The OPA expressed the opinion that increased labor efficiency and elimination of overtime would help to offset some of these higher costs.

In addition, the pricing system previously announced for items manufactured for sale by makers of tools, dies, jigs, and fixtures, has been extended for use by them also when these items are made and used specifically with any product and sold in conjunction with that product.

Copper, Lead Boosts

In addition, a 2⅜¢ cents per pound increase has been granted on copper produced from mines which have granted approved wage increases since February 14. This lifts maximum prices for such copper to 14⅜¢ per pound at Connecticut Valley points, in carload lots; in smaller lots the price is 14½¢. Copper produced from other mines continues at a 12¢ maximum price.

The price of lead has been increased by 1¾¢-a-pound from 6.5¢ to 8¼¢ per pound. A similar increase was granted for secondary lead and for primary and secondary antimonial lead, but the lead scrap price was only raised 1.55¢-a-pound.

Although OPA indicated that subsidy payments would continue to be made to marginal producers, it stated that the new price ceilings for copper and lead would permit a reduction of $7,500,000 a year on such subsidy payments.

Storage Batteries, Pumps

Maximum prices for industrial electric storage batteries were increased by 10% over base price levels, effective June 4th. This interim increase does not apply to automotive batteries. Resellers of industrial storage batteries are permitted a "dollars-and-cents pass-on" of the price increase.

Manufacturers of power-operated pumps and equipment were granted an interim increase of 15% over base prices when sold with the power unit, and 8% when not sold with the power unit, effective June 5th.

Georgia Tech Expands Research

ATLANTA—Georgia Tech has organized the Georgia Tech Research Institute as successor to the earlier Industrial Development Council due to the increased volume of industrial research and development conducted at the school. The Institute will implement and coordinate the utilization of Georiga Tech research facilities for industries, associations, government agencies or individuals in search of new or better products, in the development of technical processes, or the prosecution of fundamental research.

The non-profit organization is headed by Fuller E. Calloway, Jr., chairman, with Gerald A. Rosselot as director of research.

Machinery Dealers Discuss Surplus at MDNA Meeting; Goldman Re-elected

ATLANTIC CITY—Used machinery dealers, attending the fifth annual meeting of the Machinery Dealers National Association, at the Claridge Hotel here, were greatly concerned over the difficulty in securing parts required for rebuilding used tools. Such difficulties were reported to be holding up some important rebuilding work.

Harvey Goldman, re-elected president of the Association, reported that dealers had sold $50,000,000 worth of surplus machine tools thus far. He pointed out the association's hard work on behalf of its members with respect to OPA prices, and providing information on surplus prices, regulations, and so on. He stated that the association had been greatly strengthened by this activity.

W. P. Kirk, president, National Machine Tool Builders' Assn. and vice-president, Pratt & Whitney Division, Niles-Bement Pond Co., warned dealers against exporting used equipment without adequate rebuilding. He stated that the export market for U. S. equipment was ruined after World War I due to improper rebuilding of used machines sent abroad. He expressed the feeling that better rebuilding standards would come out of the association's efforts.

Harvey Goldman

Rebuilding Important

Mr. Kirk emphasized that machine tool builders do not feel any enmity toward used machinery dealers. He said that a good used tool market bolsters a good new tool market, and that a good rebuilding job by used equipment dealers was an added recommendation of the manufacturer's product through permitting better service for the second-hand tool users.

At panel discussions, methods of standardizing machine tool rebuilding were taken up, and the many problems involved were pointed out. In addition, the subject of securing surplus equipment for used equipment dealers to use in rebuilding second-hand units was also taken up.

Besides Mr. Goldman, Mr. Randolph K. Vinson was re-elected as Executive Director. New officers include George T. McClennan, of McBride & McClennan, Phila., Pa., as 1st vice-president; Joseph T. Weiss, of Interstate Machinery, Chicago, Ill., as 2nd vice-president; and Charles A. Simmons, Sr., Simmons Machine Tool Co., Albany, N. Y., as treasurer.

Held from May 29-31, the meeting was attended by 185 dealers.

Washington Bulletin

Plane Aluminum Scrap

A proposal that salvage operators acquire, on a bid basis, five major Army surplus aircraft fields, and sell the aluminum alloy to fabricators, was made at a meeting of the Aluminum Smelters Industry Advisory Committee with War Assets Administration. The fields are at Albuquerque; Clinton, Okla.; Kingman, Ariz.; Ontario, Calif.; and Walnut Ridge, Ark. The airplanes would yield about 40% of their airframe weight, or 189,000,000 pounds of aluminum alloy. About 22,000,000 pounds are available at other fields. To guard against monopoly, one company, or an amalgamation of small operators, could acquire only one field.

Army and Navy will report aluminum available in overseas theatres. Hawaii has between 10 and 30 million pounds, mostly in crashed and obsolete planes. The Committee was amazed at the disparity between total planes delivered to the military and the small number reported for junking. WAA has a detailed report on the aluminum situation.

Compulsory Labor Arbitration?

Compulsory arbitration of labor-industry disputes, proposed many times in the past without result, is again under consideration by some members of Congress. Since all other disagreements are settled in courts, sponsors see no reason why unions and management should be exempted. Some sort of permanent protection of the nation's interest against strikes seems bound to come. If legislation is proposed it will provide for special commissions or labor courts, with appeal by either party to the Supreme Court. Enforcement would be by injunction; striking employees would lose their status, and pickets would be subject to criminal action. Industry-wide unions might be curbed under anti-trust laws. Probably basic industries, like steel, coal and public utilities would be affected initially.

Atomic Submarines

The Navy is going out of its way to display a progressive attitude for whatever it may be worth in its battle against unification of the armed forces. Navy's Office of Research and Inventions will spend about $250,000,000 on new kinds of fleet and air weapons. One project it has in mind is deep-water submarines which could avoid nearly all forms of attack. Tests with high-pressure resistance hulls are being prepared. Navy hopes for atomic power which would require no air and would permit long runs without surfacing. Atomic energy would be applied as new source of heat in otherwise-conventional steam plants. The heating element will be very heavy, indicating initial use in stationary and marine engines, and precluding for a long time its adaptation to aircraft. Navy is also talking up its research on protection against atomic bombs, rocket missiles, and supersonic aircraft speeds. Some of the admirals even admit that the surface fleet is obsolete.

Magnesium Forging Research

The Government has decided to keep the 18,000-pound magnesium forging press, which was started as a war project at the Wyman-Gordon magnesium plant at Worcester, Mass. It is the largest magnesium press ever built in this country. Army and Navy will use it to try out advanced forming ideas, and industry will be given whatever know-how is gained. Washington is anxious to promote the infant magnesium industry, as a backlog of capacity for emergency.

STEEL FIRM TO SUPPLY KAISER-FRAZER, GRAHAM

CLEVELAND—Difficulties in securing steel for the new Kaiser-Frazer Corp. and for Graham-Paige will be largely solved through the formation of a new steel company, to acquire raw steel capacity, and an agreement for the processing of this steel into sheets. The new company, Portsmouth Steel Corp., will acquire for $12,000,000 the Portsmouth, O., works of the Wheeling Steel Corp. The mill has a monthly capacity of 50,000 tons of steel ingots, and can process the metal into slabs, sheet bars, tie plates, and wire products.

The transaction includes an agreement by Wheeling Steel to roll steel sheets for Kaiser-Frazer and Graham-Paige at Wheeling's Steubenville, O., mill. Sheet bars will be supplied by the Portsmouth mill.

The new company is headed by Cyrus S. Eaton, who will be chairman. However, it is substantially backed by the two automobile companies, since Kaiser-Frazer has agreed to purchase 200,000 shares of its stock while Graham-Paige will buy 100,000 shares. Total capitalization of Portsmouth steel is 1,025,000 common shares.

The Winner And Still Champion—Having won the bulk of his demands, the serious-faced John L. Lewis shakes hands with the smiling and relieved President Harry S. Truman as the pleased "Cap" Krug, Secretary of the Interior, looks on. The strike had caused the loss of some 76,000,000 tons of soft coal, and prevented the production of 4,500,000 tons of steel. Coal prices will be boosted to pay for the 18½-cents-an-hour pay rise for the coal miners, the 5¢-a-ton royalty, reduction in working hours from 54 to 45 weekly, $100 per miner for vacation pay

Congressional Mill Grinds Slowly on Labor Legislation; Lewis Wins Again

WASHINGTON—Organized labor has not been accustomed to having a friendly Chief Executive ask for restrictive legislation, even though of an emergency nature, and having Democratic-controlled House and Senate twice (by large majorities) vote for laws regulating the right to strike and other union activities.

But that is exactly what has happened. The result has been to confuse labor's political lineup and stimulate increased political activity both by the C.I.O. Political Action Committee and the A. F. of L.

Lewis Outpoints Murray

In the soft-coal agreement with the government Lewis got what he set out to get: more than the 18½¢ hourly increase won by Murray's steel workers and other C.I.O. unions. The miners received not only an 18½¢ increase, but an increase in vacation pay from $75 to $100 and a royalty of 5¢ a ton to go into a welfare and retirement fund to be managed jointly by the government and the union. The union will administer a medical and hospital fund supported by deductions from miners' pay.

Return of the mines to the operators awaited approval of price relief by O.P.A. and acceptance by the owners of the collective bargaining contract made by the government. The operators would replace the government in administering the welfare and retirement fund, which would be used for sickness, disability, death and retirement.

Not long after Congress sent Truman the Case bill, which he didn't want, it took favorable action on emergency anti-strike legislation, which he did ask for, although some important features were eliminated.

Senate Cuts Labor Curb

The Senate made three important deletions from Truman's emergency proposal, which had rolled intact through the House with only 13 votes being cast against it. It:

1. Denied the President authority to draft strikers.

2. Killed a provision which would have turned profits realized under government operation of a plant into the U. S. Treasury and would have allowed the private owners only "just compensation" for use of the property, regardless of whether the company or union was at fault in the strike or threatened strike which brought about seizure.

3. Discarded a clause which would have denied seniority rights to strikers.

Strike End Sought

The emergency proposal, requested after the railroad strike had paralyzed the entire nation and applicable only when property was under government seizure, would for the first time require both employer and union leader to take "appropriate affirmative action" to end a strike or lockout. Strikes or lockouts after presidential proclamation of a national emergency became effective (at least 48 hours after the announcement) would be illegal. Violators of either of these provisions would be liable to $5,000 fine or one-year imprisonment, or both, and subject to possible injunction proceedings.

Strikers who do not return to work or who go on strike after the presidential proclamation has become effective, would lose their status as employees under the Wagner Act or the Railway Labor Act.

The obligation of union leaders to seek an end to a strike and the loss of employment to individual strikers would be two improvements over the Smith-Connally Act. Under this act there was no requirement, for instance, for Lewis to ask his miners to end their strike, and individual miners could not be penalized for staying on strike.

However, the emergency legislation was intended only for the reconversion period ending six months after the official ending of the war and would apply only in government-operated plants where a dispute threatened the public health or security and the national economy.

Strikes, OPA Ceilings Hamper Copper, Lead Productions; Prices Boosted

WASHINGTON—Short copper supply has become one of the most serious obstacles in the way of production. Electric wiring is almost out; scores of producers' and consumers' items are nearly out of production for want of copper; most serious of all are electric motors, which are lacking for machine tools, many types of machinery, and a long list of appliances for homes, industry, and transportation. A close second to the copper problem is lead, and of course brass.

The output of fractional horsepower motors is already three months behind requirements, and barring improbable early relief in copper, motors may lag two or three months more.

OPA Blamed

Mainly the copper and lead bottlenecks are due to cost-price differentials, which are charged by critics to OPA and to strikes in both mines and smelters.

The Government's wage-price policy says that employers must act on their wage increases first, on the basis of which they will then present their price increase claims. But, under pressure from the copper state congressmen, the Wage Stabilization Board authorized the 18½¢ increase in advance. The operators still haven't settled with the unions—excepting Anaconda. Points still contested by operators and unions are retroactivity of increased pay, the common labor rate, and some union rights.

OPA on June 3 increased the price of copper 2⅜¢ per pound to 14⅜¢, and lead 1¾¢ to 8¼¢ per pound, making possible a reduction of about $7.5 million in federal subsidies under the premium payment plan. The Senate Banking Committee, meanwhile, has voted a $100,000,000 addition to the subsidy fund for lead, copper, and zinc for the period beginning July 1 and through June 30, 1947.

Output Hit Hard

However, since there is little production of copper, the price and subsidy actions make very little immediate difference. The situation can be helped only through quick action by unions and employers in mining, smelting and refining. While strikes in coal and railroads have engaged public attention, the non-ferrous tie-up has done industry irreparable damage.

The lead shortage is so serious that no matter what is done about prices and production, there can be no relief for months to come. The salvage program will not be a drop in the bucket. Industry needs over a million tons of lead this year, and cannot possibly get over 700,000 tons. In view of this fact, producers are surprised and disappointed that their new price, with the increase, is 8¼¢. whereas they had hoped for 8¾¢ or 9¢. Imports have been running about half of the 1945 rate. Probably the government will have to pay more than its ceiling for lead; Mexican lead is selling for 8½¢ at Gulf ports.

The Wage Stabilization Board's approval of 18½¢ applies to zinc, as well as to copper and lead, but the zinc controversy is so involved that OPA is withholding its price decision for a couple of weeks.

Steel Operations Recovering, But Many Products Will Continue Short

PITTSBURGH—Once again the steel industry is in course of recovering from the effects of a strike which had sent the national ingot rate down from 90 percent to 44 percent. Once again, too, it is being demonstrated that the steel industry can effect a rapid recovery from the shutdowns forced upon it by a series of walkouts, this time by a coal strike that lasted for nearly two months.

It is considered likely that three weeks will be sufficient to permit recovery of ingot production to an approximate normal, or above 80 percent, rate. The end of the coal strike and the definite assurance that coal will cost more tends to revive speculation that an application will be made for new price relief by the steel industry, but Washington officialdom indicates that resistance to such a move may be expected.

Possible price action is also brought to the fore by the revelation that the RFC is absorbing $10.34 per ton in the form of a subsidy on sheet bars which Jones & Laughlin is turning out and which the Governmental agency is turning over to five non-integrated sheet mills to keep production going at their plants. It was disclosed that J & L was being paid $45.84 per ton for the sheet bars.

Mill Schedules Upset

Steel mills are in the midst of a normal confusion which follows a protracted period of idleness or poor operations. Mill schedules were completely disarranged and backlogs increased and tangled by happenings. Intra-mill movement of steel was disorganized and material in process of manufacture sharply cut as inventories of semi-finished were carried to completion. Customers are now besieging the mills for early shipment of their orders and quotas have to be reestablished to give each consumer some form of relief in the way of tonnage. At the same time, more essential steel uses are constantly in mind and tin plate manufacture will continue to receive priority on raw steel. The steel companies, also mindful of their more profitable times, will shunt substantial amounts of new steel to cold-rolled sheets and seamless tubing. A form of priority also has to be maintained to keep up a flow of nails from the mills as pressure for products used in construction is tremendous.

Inventories of steel in the hands of consumers generally are reported as poor in all important segments of industry. Where some items may be in larger supply, there are certain to be steel parts woefully short and whole operations are down as a result. Consumers therefore expend primary efforts to get increases in supplies of the parts which are in shortest supply. How much success they will have time will tell but industrial equilibrium will take a year to achieve. For instance, it is reported, it will take more than a year to catch up on orders for fractional horsepower motors.

Relief in 1947

It is expected that productivity in the steel mills will proceed at a high rate once normalcy is attained, if hot weather does not interfere too much. If there are no strikes, therefore, a large steel outpouring will take place this fall. Steel orders on the books will run mills over into 1947 and there has been reluctance to take business for next year until it is more definitely determined what the producer's real obligations may be.

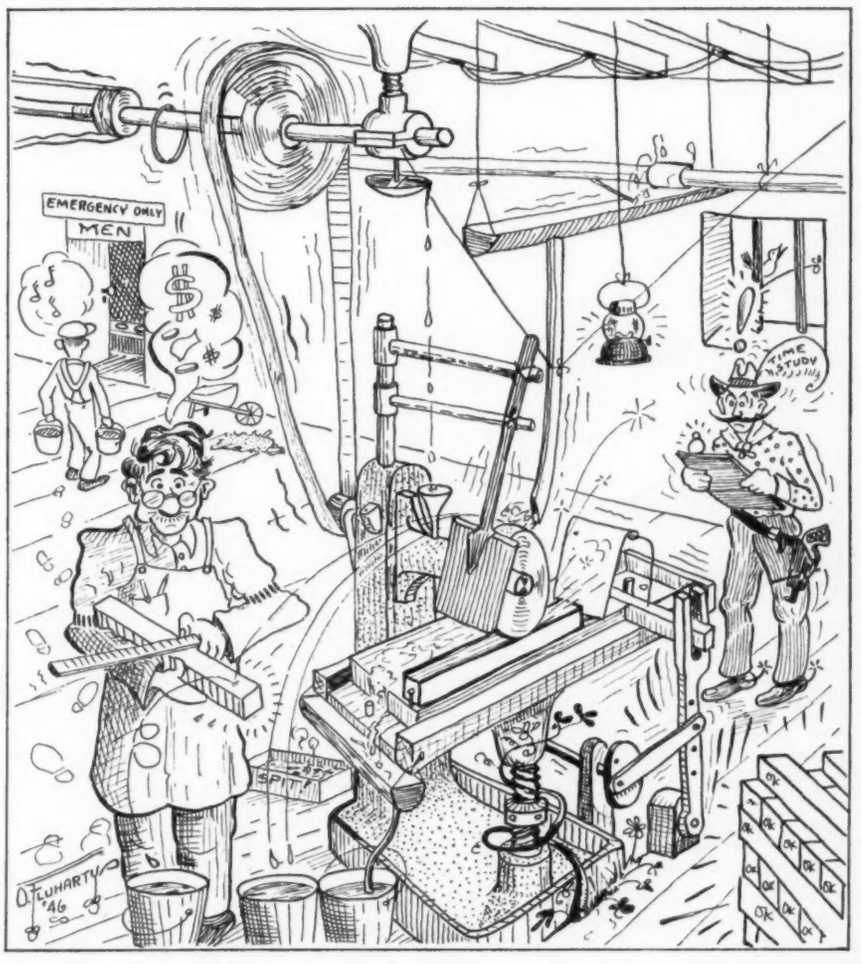
A propaganda movement to improve the scrap supply is underway. Not only is scrap itself scarce but there were inroads upon mill stockpiles during the extended period of the coal strike when supplies of hot metal were restricted.

It may be predicted that cold-rolled sheet demand and supply will come into first balance at the close of 1947. This gives some idea of the obligations of the steel companies to the automobile industry.

WAA TO SELL BENDIX SURPLUS EQUIPMENT

ELMIRA, N. Y.—The War Assets Administration will offer for sale to industry beginning July 15th some $4,000,000 worth of machine tools and other equipment from the Bendix Aviation Corp. plant here. Priority groups will make their selections before that date. Site of plant is 1051 South Main St. Sales are under jurisdiction of the N. Y. Regional Office of W.A.A.

OUR SHOP . . .——*Precision Grinding Department*



New Construction and Expansion

Willys-Overland Motors, Inc., has started a $21,000,000 expansion program which provides for a more largely self-contained automotive plant at Toledo, which will have an eventual yearly capacity of 300,000 vehicles. The company has already purchased the **Wilson Foundry Co.,** Pontiac, Mich., the largest gray iron automotive casting plant in the country, for $3,700,000. Other expenditures by the company are expected to include: $14,300,000 for machinery, tooling and expansion at Toledo; $2,300,000 for the purchase of land and buildings at the present plant; and $700,000 for new machinery and assembly plant equipment at the Los Angeles plant, which will be reopened soon.

Chrysler Corp. has purchased the 1,000,000 sq. ft. Graham Paige plant at 8505 W. Warren Ave., Dearborn, Mich. At present the plant is under lease to R.F.C. and the U.S. Corps of Engineers.

Ford Motor Co. is transferring its truck and bus production in the Detroit area from the Rouge plant in Dearborn to the Highland Park plant. More than $2,000,000 will be spent to accomplish the transfer.

The Cleveland Graphite Bronze Co. has purchased a factory building in Fort Wayne, Ind., from the **National Can Co.,** where the Cleveland concern will start the manufacture of bearings as soon as possible.

Electro-Motive Div., General Motors Corp., has leased the property known as the Pullman Airplane Wing plant, 103 St. and Cottage Grove Ave., Chicago, from the War Assets Administration. The 600,000 sq. ft plant will be used for the fabrication of many of the sub-assemblies now built in the main plant and elsewhere.

The S & S Tool & Mfg. Co., Detroit, has purchased from the War Assets Administration, the plant it has been operating at 19720 Eight Mile Rd. The $125,602 sale included land, buildings and equipment.

The Ross Carrier Co., Benton Harbor, Mich., has purchased, for $12,133 from WAA, the land and buildings leased and operated by the company during the war for the production of industrial carriers and lift trucks.

The Allied Machine & Engineering Co., New Philadelphia, Ohio, has bought the plant it operated during the war for the manufacture of ball and roller bearing nuts, special lock nuts and similar machine products. The plant was sold by WAA for $135,364.

The Hodges Armature Co. has acquired the partially completed industrial installations at Memphis, Tenn., originally intended for use by the **Reynolds Metal Co.,** for $65,000 from WAA. The new owner will complete the structures and manufacture automotive electrical equipment.

The Bendix Aviation Corp., plant at Owosso, Mich., has been leased to the **Gibson Refrigerator Co.,** through WAA for five years. The plant will be used for the production of electric ranges and refrigerators.

The Aluminum Company of America plans to construct an aluminum sheet and plate rolling mill near Davenport, Iowa. The plant, which is to cost more than $30,000,000, will have the capacity to produce more than 10,000,000 lbs. of sheet and plate per month when placed in operation.

Radio Condenser Co. has acquired the Camden, N. J., plant where it produced variable condensers for communication equipment during the war, from WAA for $154,986. Condensers for radio and radar equipment will be made at the plant.

The Hardman Tool & Engineering Co., Los Angeles, Calif., has purchased the aircraft parts manufacturing plant of **Industrial Fabricators Co.,** Burbank, Calif., through WAA for $135,000 for the manufacture of airplane equipment.

The Electric Auto-Lite Co. is constructing a new battery plant at Vincennes, Ind. and a new manufacturing plant at Sharonville, Ohio, as part of its plan to increase production.

CKellett Aircraft Corp. plans to expand its operations through the lease of the War Assets Administration-owned surplus war plant at North Wales, Pa., for five years.

Westinghouse Electric Co. has started a $1,500,000 long-range construction program to convert the **Curtiss-Wright** plant in Buffalo from the wartime assembly of airplanes to the peacetime manufacture of electric motors. It is expected that it will take a year to complete each of the two major projects involved—the reconversion of the main floor space set aside for the manufacture of motors and the installation of a copper plant to form and insulate electric wiring.

The Bethlehem Steel Co. is working on a $20,000,000 expansion and modernization program at its Lackawanna, N. Y., plant. The company plans to have its new 22,000-ton bar mill ready for operation this fall.

Ajax Flexible Coupling Co., Inc., Westfield, N. Y., has purchased an 11-acre site for the immediate erection of a new factory for the Screen and Conveyor Div., of the firm.

The Tawco Products Co., Columbus, Ohio, will purchase additional machine tools, including milling machines, grinders and lathes, to permit expansion of the company's output.

Rochester Products Div., General Motors Corp., has started construction of a new engineering building for research in motor fuel carburetion. The new building, which will contain 30,000 sq. ft., will cost about $100,000.

American Metal Bearing Co., Los Angeles, Calif., has purchased land in Dallas, Texas, where it will construct an office building and warehouse costing more than $250,000.

Timken-Detroit Axle Co., Detroit, has leased two manufacturing plants from the government—one in Detroit near the main plant and the other in Melvindale, Mich.

Duro Test Co., North Bergen, N. J., is building a 68,000 sq. ft. factory to allow for expanded production.

Wooldridge Manufacturing Co., Sunnyvale, Calif., will add more than 100,000 sq. ft. of floor space to its plant. New buildings and equipment will cost an estimated $400,000.

Link-Belt Co. will build a new plant at Sixth Ave., So. and Hinds St., in Seattle, Wash., to replace its present structure at 820 First Ave., So.

The Southwest Machinery Co. has begun construction on a $150,000 equipment repair shop in Tulsa, Okla.

Verson Manufacturing Co. has started the building of a $600,000 plant in Dallas, Texas, where stainless steel kitchen utensils will be manufactured.

The Carrier Corp., Syracuse, N. Y. plans to improve and expand its plant facilities. This is in addition to the $4,500,000 expansion program announced in January.

Technical and Commercial Problems Discussed at A.G.M.A. Meeting

HOT SPRINGS, VA. — Technical standards were advanced and commercial problems discussed at the 30th annual meeting of the American Gear Manufacturers Association held at The Homestead, June 3-5. A record attendance of 175 members and guests marked this first postwar gathering. The slate of officers elected for the coming year was headed by T. J. Bannan, Western Gear Works and Pacific Gear Works.

A paper describing a test for the surface durability of gears was presented by T. H. Wickenden, G. R. Brophy and A. J. Miller, International Nickel Co. The authors showed the design and operation of a special machine for determining surface fatigue of gear teeth. The point of failure was found by a marked increase in gear noise as measured by a meter constructed especially for the purpose. Test data were plotted for SAE 4645 steel of three different degrees of hardness.

Gear Generation Development

George H. Sanborn, chief field engineer, Fellows Gear Shaper Co., talked on gear generation, giving an outline of its development. He then showed two color movie films, one on the art of gear generating and the other on gear cutting and testing equipment.

In response to the keen interest in surface roughness of gears several sessions were held on the subject led by L. D. Martin, Eastman Kodak Co. Mr. Martin told of his experience with surface measuring devices and displayed a series of masters which he offered as a basis for a surface finish standard. He stressed the necessity of making specimens by the same methods used in gear cutting so they would have similar characteristics of waviness and lay. Standard masters can be reproduced by the electroforming process developed by the U. S. Rubber Co.

Ray B. Tripp, association vice president-elect, described the work of the OPA Industry Advisory Committee and commented on the recent price relief granted the gear industry. His remarks were followed by a panel discussion, using "Information Please" technique and led by A.G.M.A. president Paul W. Christensen. Experts on the panel were W. L. Schneider, Falk Corp., L. R. Botsai, Westinghouse Electric Corp., Howard Dingle, Cleveland Worm and Gear Co., Thomas J. Bannan, Western Gear Works, R. B. Salinger, Massachusetts Gear and Harper Jackson, Jackson Gear Works. Such general topics as wage incentives, returned materials, sales forecasts, spare parts and the keeping of records were ably discussed.

Standardization Progress

Marked progress in gear standardization was reported by the technical committees under the general chairmanship of S. L. Crawshaw, Western Gear Works. Tentative standards on cast iron gear blanks and gear lubrication were made A.G.M.A. standards. Five new tentative standards were reported ready for distribution to the A.G.M.A. membership for comments pending final action.

A feature of the annual dinner was the award of plaques to all the association's past presidents. J. O. Almen, General Motors Corp., was recipient of the Edward P. Connell Award.

Besides Mr. Bannan and Mr. Tripp, new officers of AGMA include W. L. Schneider, Falk Corp., as treasurer, and Newbold C. Goin, executive secretary. New executive committee members include: C. B. Hamilton, Hamilton Gear Co., F. H. Hoge, Jones Foundry & Machine Co., W. W. Trout, Lufkin Foundry, and F. W. Walker. Philadelphia Gear Works.

A.G.M.A. Officers and Award Winner

Thomas J. Bannan
President

Raymond B. Tripp
Vice President

John O. Almen
Award Recipient

Automotive Engineers Preview Future Auto at SAE Meeting

FRENCH LICK, IND.—Engineers at the Summer Meeting of the Society of Automotive Engineers were given a preview of possible 1950 automobiles, equipped with supercharged engines with high compression ratios, with independent wheel suspensions, hydraulic steering, and rubber torsion springs. In contrast to this, it was pointed out that European cars would probably have to be small, streamlined vehicles, featuring economy of operation.

Speculation on future American and European cars was only one interesting phase of the engineering and designing outlook covered by major speakers at the sessions held at the French Lick Springs Hotel from June 2 to the 7th. Tomorrow's small five-passenger car, equipped with rubber torsion springs, consisting of rubber cylinders bonded internally to central shafts and externally to outer shells, was exhibited and described by A. S. Krotz, R. C. Austin, and L. C. Lindblom, of B. F. Goodrich Co. The car featured steering accomplished by two balanced hydraulic circuits, kept under minimum positive pressure.

Plastics Declared Unsuitable

Plastics were declared unsuitable currently for use in auto windshields, since they are difficult to clean, resist wiper action during rainstorms, and hold ice and snow, according to G. B. Watkins and J. D. Ryan of Libbey-Owens-Ford Glass Co. Aluminum alloys containing tin, nickel, silicon and copper were recommended by H. Y. Hunsicker and L. W. Kempf, Aluminum Co. of America, as new materials for bearings to aid design of internal combustion engines.

A detailed paper on methods of calculating the performance of jet engines with explanatory charts and formulas was presented by Ray E. Bolz, head of the Jet-Engine Combustion Section, NACA.

In a talk on the postwar outlook for alloy steels, Robert S. Archer, Climax Molybdenum Co., pointed out that greater knowledge of conditions necessary for maximum combinations of strenth and toughness in steel indicate that new levels of performance seem attainable from alloy steels.

Spotting the Air News

Midwest Plants Recovering From Strikes; Bottlenecks Cut Output

CHICAGO—Although Chicago plants are swinging back into production from their recent strike paralysis, the imbalance of materials and parts, and shortage of experienced personnel is keeping production limping along. Moreover, the actual quantity of goods turned out in the last nine months is certainly a small trickle in comparison with last Fall's schedules.

Electro-Motive division of General Motors reports that since the end of the war its plants have been closed more than half of the time, and production thus far, which was expected to approximate 500 diesel-electric locomotive units, has actually not exceeded 200 units. The production loss is estimated at $30,000,000.

Another company that is lagging behind VJ-day expectations is Pullman-Standard. Passenger car production is 60 per cent below schedule—the company has actually started and completed only 39 cars since the end of the war in the Pacific. Another 250 cars are held uncompleted for lack of seats, air conditioning and other electrical equipment, roller bearings, hardware and other components.

Caterpillar's Sales Down

Sales of Caterpillar Tractor have been off more than one-third since the end of the war from the expected amount. In addition to the usual reasons for the drop in output—strikes and material shortages—Caterpillar is also suffering from a lack of workers. The company now employs 50 per cent more workers than prewar.

A large proportion of the 2,000 new refrigerator cars ordered by the Pacific Fruit Express Co. will be manufactured by Chicago area firms, including Pullman-Standard and General American Transportation Co. The cars will be made of lighter metals than the conventional "reefers" and will weigh about 4,000 pounds less. A number of other structural changes have been adopted.

Production of aluminum sheet for housing purposes has started at the McCook, Ill., aluminum rolling mill recently acquired by Reynolds Metals Co. Using scrap aluminum as a base, the company will turn out low cost housing materials such as corrugated aluminum sheet. The use of scrap cuts the cost of aluminum sheet in half. The concern expects to exceed rated capacity to turn 24,000,000 pounds of sheet aluminum monthly.

Correction on British Photo

In the May 9th issue of *American Machinist*, page 148b, the photo of a British car was coupled with a discussion of the British Standard auto. The car shown in the photo actually was a Morris Eight 4-door Sedan, produced by Morris Motors, Ltd., Cowley, Oxford, England.

Twin Jet Plane

Air Force's Douglas XB-43, a twin jet version of the Douglas XB-42 "Mixmaster," so called because of its counter-rotating pusher propellers on the tail, has made a trial flight. Its two TG-180 turbo jets developed about 4000 pounds of thrust, and the machine is expected to reach a speed exceeding 500 m.p.h. The Mixmaster, powered by two Allisons buried in its hull, was considered for conversion from bomber to transport to be known as the DC-8, but there is no indication of plans for converting the XB-43 to transport service.

Passenger Plane Speeds

Air transport operators have suggested that NACA make a study of passenger cabin conditions on airliners expected to reach a speed of 400 m.p.h. It is possible that jolting in turbulent air would be too much for the traveling public. There is no turbulence at high altitudes, but the long climbs and descents would have to be taken at slow speed, curtailing anticipated fast schedules.

Jet Engine Types

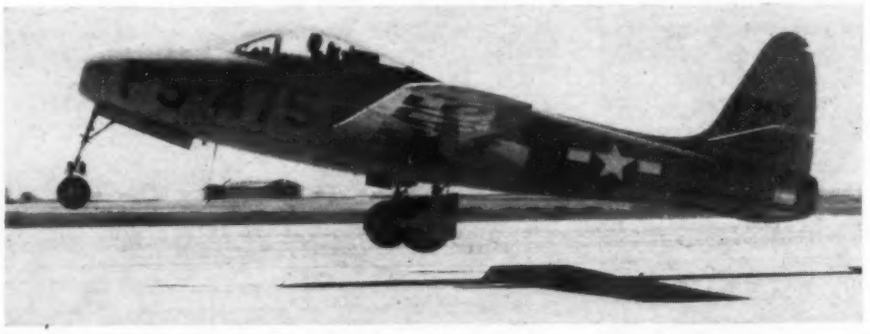
Two kinds of jet engines function without any moving parts whatever. They are the resonance jet, or reed-valve jet used by the Germans in their buzz bombs, and the athodyd, a simple venturi tube. The resonance jet takes air in at the front through spring valves like the reeds of a harmonica, mixes it with fuel, and the explosion gas goes out the back because the reeds close against the front. The resonance jet takes air at the front and blows out at the back for reasons only an expert can understand. In both of these engines, air is forced in at the front by the ram effect of forward speed. Engineers are working diligently on both types, hoping to develop aircraft power plants with no machinery at all. Noise and concussion of the reed machine at present are beyond human endurance.

Supersonic Speed Tests

Two airplanes are being used now by AAF to explore the realm of supersonic speed. One is the Bell P-35 Kingcobra fighter, which has been equipped with sweep back wings to counteract shock wave. This plane will not fly at supersonic speed (700 to 800 m.p.h.) but it will throw light on the problem of controlling supersonic planes at the slow speeds necessary in landing and takeoff. Sweepback wings have also been tried on the Curtiss Ascender XP-55. Only suggestion so far, to handle both slow and high speed, is to develop wings capable of variable sweepback angles.

GM's Jet Engines

Allison division of General Motors is now the largest producer of engines for Army Air Forces. Deliveries of the J-33 jet engine, which GM developed as the I-40, and which powers AAF's Lockheed P-80s, and of the reciprocating liquid-cooled V-1710, which powers the North American P-82 twin Mustang, will total about 9,000,000 h.p. by the end of 1947. This program will entail employment of 6000 workers and will utilize all of Allison's wartime production facilities, including the Maywood plant at Indianapolis, under new lease with RFC.



Army's Newest Jet Fighter, The XP-84—Shown leaving the ground on a take-off at Muroc Field, Cal., the new Republic Thunderjet (XP-84) has been revealed by the Army to have a speed of over 590 miles an hour, service range of 1,000 miles and a ceiling above 40,000 feet. The plane has a tip wing span of 36 ft. 5 in. and an overall length from nose to tail of 37 ft. It weighs 9,000 lbs. Major design difference is that the air scoop is located in the nose of plane.

Canadian Unions Attack Wage Controls in Strike Threats

OTTAWA—Strikes aimed generally at a 40-hour week and pay increases on the order of 25 cents an hour promise to spot the Canadian labor picture all summer.

In their demands for higher pay and shorter hours most unions followed the policy line set by the Canadian Congress of Labor (CIO) in ignoring federal government wage regulations. In effect the strikes and threatened strikes took on the character of action against wage control rather than against the employers since even where employers were willing to grant increases demanded they were forbidden by law to do so without government approval.

Auto, Rubber Threat

In the automobile industry, situations were developing which are likely to result in strikes before the summer is over. A threatened strike in the rubber industry was put off by appointment of an investigating commission but should the commission's findings fail to result in a settlement a walkout there can occur. Canadian coal miners, unlike their brethren in the Lewis camp south of the border are not causing trouble.

Steel production is dropping due to diversion of coke from steel plants to other industrial users given a higher priority. Foundries and metal working industries are using up stocks of both coal and metal. A strike at the Anaconda American Brass plant in Toronto leaves firms dependent on that concern short for brass and copper. A decline in the production of iron castings has taken place which will slow up further concerns producing farm implements and tools, cars, trucks and railway equipment.

ASSOCIATION NEWS

The American Society of Body Engineers, Inc. has been formed with **I. Louis Carron,** body engineer of the Detroit Harvester Co., as president. National headquarters of the organization, which is composed of body engineers from practically all the companies in the automotive industry, is in the Rackham Memorial Bldg. in Detroit.

Officers for 1946 of the **Automotive & Aviation Parts Manufacturers, Inc.** include: president, **Frederick C. Crawford,** president of Thompson Products, Inc., Cleveland; vice president, **John Airey,** president, King-Seeley Corp., Ann Arbor, Mich.; and secretary-treasurer, and **J. L. Myers,** executive vice president of the Cleveland Graphite Bronze Co., Cleveland.

Names in the News

Walter P. Berg

Frank J. Wood

Walter P. Berg has been appointed general manager of the machinery division of the Dravo Corp., Pittsburgh, succeeding **W. K. Fitch,** who recently became chairman of the board. Mr. Berg has been with Dravo for 23 years and since 1938 has been in charge of the division's power department.

Frank J. Wood, associated with the Goodman Mfg. Co., Chicago, for the past 10 years, has joined Loewy Construction Co., Inc., New York, as chief engineer of the rolling mill division.

W. H. Waters has been appointed assistant vice president of the American Car and Foundry Export Co., New York City.

Edmund F. Martin, formerly assistant superintendent of the Bethlehem Steel Co's. Saucon Div., Bethlehem, Pa., has been named an asisstant general manager of the Lackawanna plant.

William S. Jack, former chairman of the board, has been named president of the recently merged Jack & Heintz Precision Industries, Inc. Other executive changes include **B. C. Milner, Jr.,** former president, who was been named chairman of the executive committee, and **Byron C. Foy,** director of the Chrysler Corp., who has been named chairman of the board.

G. E. Gude, Jr., sales manager of the Wyatt Metal & Boiler Works, Dallas, Texas, for the past 10 years, has also been elected a vice president and director of the firm.

George L. Best, formerly assistant vice president of the American Telephone & Telegraph Co., has been elected vice president of the Western Electric Co.

Robert I. Warnecke has been appointed chief engineer of the Roberts-Gordon Appliance Corp., Buffalo, N. Y.

H. A. Roemer, Jr., formerly executive vice president, has been elected president of the Detroit Seamless Steel Tube Co. succeeding **J. H. Dunbar,** who has become chairman of the board after serving as president for 10 years.

Jasper Van Opynen, Jr., has been appointed vice president in charge of manufacturing operations for all divisions of the Portable Products Corp., Pittsburgh.

George P. Lehman has been appointed to the newly-created post of assistant manager of the General Electric Plastics Div.

Carl W. Urban has been named master mechanic for the Mid-West Abrasive Co's. Owosso, Mich. plant. He was formerly chief tool engineer for the Plymouth Div., Chrysler Corp.

Campbell Wood, recently general manager of the Nash-Kelvinator Corp. propeller division, will be the works manager of the company's new plant at El Segundo, Calif.

Mrs. Florence M. Sayle, widow of the late **W. C. Sayle,** has been named to succeed him as president of the Cleveland Punch & Shear Works Co., Cleveland.

Carroll E. Gray, Jr., president of the Doyle Manufacturing Co., Syracuse, N. Y., and chairman of the Pittsburgh Metallurgical Co., has been elected chairman of the Sterling Engine Co., Buffalo, N. Y.

Maj. Carl R. Tufts has joined the Detroit staff of The Baker Industrial Truck Div., Baker-Raulang Co., Cleveland.

C. V. Gregory has been named Pittsburgh district manager for The Reliance Electric & Engineering Co. He succeeds **Bon J. Ballard,** who has become assistant to the sales vice president.

Charles R. Mitchell has assumed his new duties as Buffalo district sales manager of Allegheny-Ludlum Steel Corp. He succeeds **James M. Matthews,** who has been named manager of silicon-steel sales, with headquarters in Brackenridge, Pa.

Frank K. Metzger has been appointed manager of railroad sales for The Midvale Co., Philadelphia, Pa.

Kenneth P. Schory has joined the staff of Product Designers Chicago, as an executive designer.

Robert A. Rankin has been appointed sales manager of the Diesel Engine Div., Chicago Pneumatic Tool Co.

Guy M. Stone has been appointed manager of the Coshocton, Ohio plant of the General Electric Co's. plastics division, now under construction.

H. Boller has been appointed general superintendent of the Chicago Great Western Railway Co. with headquarters in Chicago.

BUSINESS ITEMS

The Parker Appliance Co., Cleveland, has combined its product development, product engineering and technical service departments into one **Engineering Div. Robert H. Davies,** formerly head of technical service, is in charge of the new division, while **Emmett C. Hartley** has become manager of a new **Special Products Div.,** which will handle rubber and plastic products.

Rolled Thread Die Co., Worcester, Mass. has appointed **P. A. Patterson Co.,** 3115 No. Broad St., Philadelphia, Pa. as its distributor in eastern Pa., southern N. J., northern Va., Del. and D. C.

Cutler-Hammer Inc., Milwaukee, Wis., has opened an office in Rockford, Ill. at 1404 No. Main St. **G. I. Wolff** will be in charge.

The Breckenridge Machine Co., Euclid, Ohio, has been purchased by **The Joy Manufacturing Co.,** Pittsburgh. **H. W. Breckenridge** and **R. W. Breckenridge** have assumed the management of the Euclid plant, which will be operated as the **Breckenridge Div. of Joy Manufacturing Co.**

Ryan Metal Products Div., Ryan Aeronautical Co., San Diego, Calif., has established eastern headquarters at 566 Bond Bldg., Washington, D. C. to handle sales and service of its exhaust manifold systems and new non-aeronautical products.

H. Leach Machinery Co., Providence, R. I., has taken over the national distribution of machine tools produced by the **Fray Machine Tool Co.,** Glendale, Calif.

Link-Belt Co., Chicago, has opened three new sales offices. The one in Moline, Ill., is located at 1608 Fifth Ave. with **M. J. Parykaza,** district sales engineer in charge. **L. R. Clark** heads the Cincinnati office at 730 Temple Bar Bldg., Main & Court Sts., while the Birmingham, Ala. office at 823 Comer Bldg., 2100 Second Ave. is under **C. C. Wiley.**

O. W. Roskill, 14 Great College St., London S.W. 1, England, engineers and economists, have appointed **C. R. Vail** as its United States representative. Mr. Vail's offices are located at 745 Fifth Ave., New York City, where he will provide commercial and technical information about the United Kingdom and certain overseas areas.

W. K. Stamets Co., Pittsburgh, has been appointed exclusive distributor of the hydraulic press line manufactured by the **Denison Engineering Co.,** Columbus, Ohio, in sections of Pa. Ohio, Md. and W. Va.

The Onsrud Cutter Manufacturing Co., Libertyville, Ill., has been formed for the production of all types of cutters required in shaping, routing and related operations.

George Fry & Associates was incorporated June 1 to continue the business of **Fry, Lawson & Co.,** Chicago and New York. **William J. Biehl** has been named vice president of the concern.

Dallas Screw Products Co., 3014 Commerce, Dallas, Texas, has been opened by **W. E. Norris.**

Carboloy Co., Inc., Detroit, has appointed **Industrial Supply Corp.,** 15th & Franklin St., Richmond, Va., as its authorized distributor in central and western Va.

The Baker Industrial Truck Div., Baker Raulang Co., Cleveland, has appointed **J. K. Mahaffey & Son,** 1006 Pitt Bank Bldg. as its new representative in Pittsburgh.

Allen-Bradley has named **Charles E. Klaus,** 1233 N.W. 12 Ave., Portland, Ore., as its representative in that area.

Aeronautical Products, Inc., Detroit, has named the **Champion Transportation Sales,** 9 So. Clinton St., Chicago, as its national railroad representative.

OBITUARIES

W. A. Givens, 60, executive vice president and director of Allegheny Ludlum Steel Corp., died May 29. Mr. Givens joined the company in 1925 and seven years later was named general manager. He held that post until 1938 when he was elected to the board and made vice president in charge of manufacturing. Two years ago he was elevated to his recent position.

Roy H. Crane, sales promotion manager of The Liquid Carbonic Corp., Chicago, died suddenly May 24. Mr. Crane joined Liquid Carbonic 20 years ago and in 1942 was named to his recent position.

William B. Patterson, 89, passed away at his home in Dayton, Ohio, after brief illness, May 20. Until his retirement last year, he was president and treasurer of the Patterson Tool and Supply Co., which he and his father founded in 1881.

W. B. Patterson

Roy H. Crane

Robert F. Devine, 58, president and treasurer of the Erie Forge and Erie Forge and Steel Companies, died May 21 in Erie, Pa.

Steven J. Gyuro, 44, president of the Gray Tool & Die Co., Cleveland, was killed May 25 when his plane crashed near Fostoria, Ohio.

William T. Bentley, 38, organizer and president of the Titan Valve & Mfg. Co., and a director of the Ferry Cap & Set Screw Co., Cleveland, died suddenly May 24.

Eugene R. Whitten, 56, general field manager and superintendent of the band saw division of E. C. Atkins and Co., Indianapolis, Ind., passed away May 26. He had been associated with the Atkins company for 40 years.

Herbert J. Robbins, 75, sales engineer for the Doehler Die Casting Co., passed away at his Cleveland home on May 24.

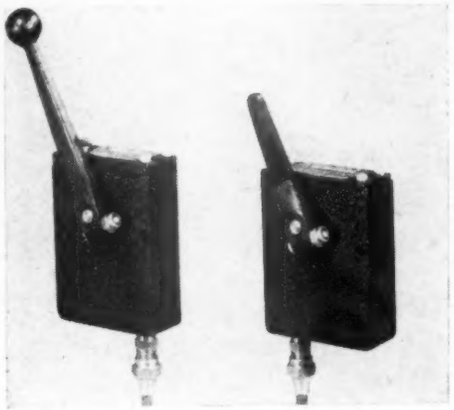
Benjamin P. B. Test, 66, designer of gas and electric furnaces, died at his home near Cleveland May 25. He was formerly with General Electric Co., but for some years has had his own consulting engineering business in Cleveland.

Kent C. Haven, service and designing engineer for the Easy Washing Machine Corp., Syracuse, N. Y., died suddenly May 30.

MEETINGS

American Society for Testing Materials. Annual meeting. Hotel Statler, Buffalo, N. Y. June 24-28. C. L. Warwick, executive secretary, 1916 Race St., Philadelphia 3, Pa.

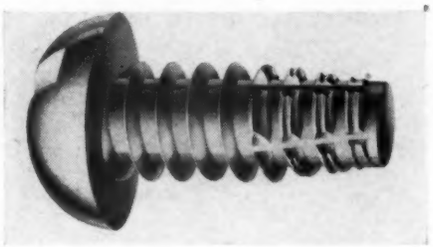
Parts and Materials



Sperry Has Remote Control Unit Of Hydraulic, Miniature Design

A miniature hydraulic remote control has been developed by Sperry Products, Inc., Dept. A, 1505 Willow Ave., Hoboken, N. J. The unit retains the advantages of larger units with only a single flexible copper tube connecting transmitter and receiver. These two units together weigh only 3.7 lb. Either arm will move through an arc of 60°, and the receiver arm may be drilled at any location to obtain the desired travel of the actuating rod.

Thin, Brittle Plastic Sections Fastened by Self-Tapping Screw



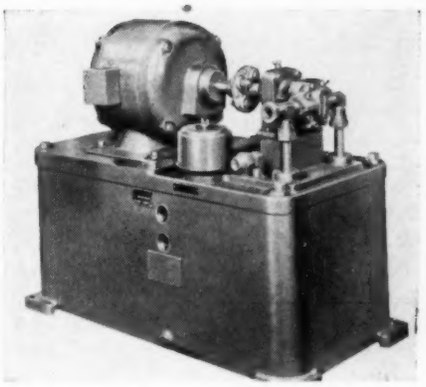
Self-tapping screw designed especially for fastening to comparatively thin sections in friable and brittle plastics is announced by Parker-Kalon Corp., Dept. A, 200 Varick St., New York 14, N. Y. The type F-Z, this screw combines the thread-cutting characteristics of Type F with the coarse-pitch advantages of Type Z. Five cutting flutes distribute cutting pressure evenly, while coarse threads eliminate binding by acting as an additional reservoir for displaced material.

Two Barnes Hydraulic Units Have 9- and 27-Gal. Capacities

Two hydraulic units, F-10-A and F-20-A, are announced by John S. Barnes Corp., Dept. A, Rockford, Ill. They have oil capacities of 9 and 27 gal. and pump deliveries of 5 and 12½ gpm. respectively.

The F-10-A is designed for light-duty machine application. It may be mounted in the machine or on a separate base and is a simple, compact unit. It includes gear pumps, overload valves, motor couplings, pressure gage, and miscellaneous parts.

The F-20-A has a high degree of flexibility and is suited to jobs requiring 2 or 5 hp. Considerable variation in delivery and pressure characteristics is possible.



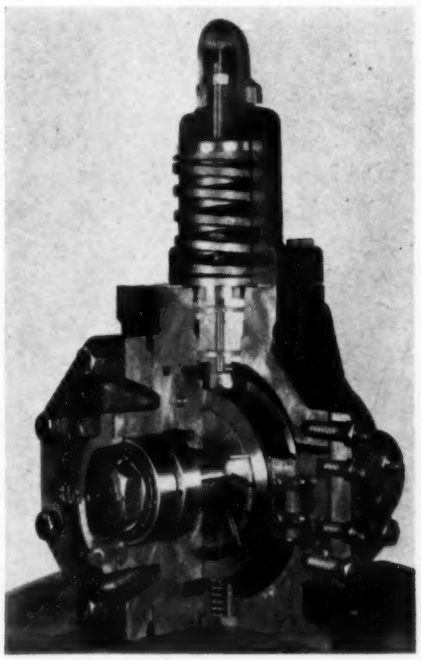
This Model F-10-A hydraulic unit has a weight of 275 lb. and delivers 5 gpm. at a maximum pressure of 500 psi.

Spherical Roller Thrust Bearing Compensates for Shaft Deflection

A new type of roller bearing said to be capable of carrying heavier loads at higher speeds and lower temperature is announced by SKF Industries, Inc., Dept. A, Front St. and Erie Ave., Philadelphia 34, Pa. Called a spherical roller thrust bearing, new bearing has a self-aligning principle which compensates for shaft deflection and distributes heavy loads evenly over all rollers. A cage retaining sleeve pressed into the bore of the inner ring makes a contained assembly of the rollers, cage, and inner ring.

Capacitors Have Higher Ratings With Cooling Coils in Oil Bath

Higher kva. ratings from a given bulk are possible with Series 1780 water-cooled mica capacitors for induction furnaces made by Aerovox Corp., Dept. A, New Bedford, Mass. The higher ratings are obtained by compact design of mica sections and other parts, and by use of a water-cooling system to provide maximum heat transfer. Mica stacks are in an oil bath with cooling coils for efficient transfer of heat.



Racine Variable Volume Pumps Have Slanted Vanes in Rotors

Variable volume hydraulic pumps are produced in three sizes by Racine Tool & Machine Co., Dept. A, Racine, Wis. Models 2, 4, and 6 have rated capacities at 1200 rpm. of 12, 20, and

30 gallons per minute respectively.

Delivery of the pump is varied by changing the relative position of pressure chamber ring and rotor to vary the displacement. A thrust bearing block containing 16 needle rollers takes the side thrust of the pressure chamber ring and allows the ring to move freely off and on center.

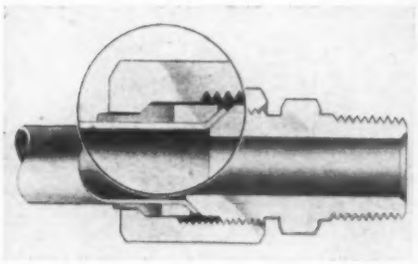
Rotors are of heat-treated alloy steel with slanted slots to permit long, thick vanes. Fifteen vanes of hardened and ground alloy steel, are hydraulically balanced to give smooth non-pulsating flow of oil.

Polished Steel Parts Protected By Fingerprint Neutralizer Dip

Cosmoline fingerprint neutralizer, produced by E. F. Houghton & Co., Dept. A, 303 W. Lehigh Ave., Philadelphia 33, Pa., provides protection for highly polished steel parts during production. The neutralizer has a water-displacing property which protects the part against rusting after being ground with a water-soluble coolant, and from the acid deposit left on steel by fingerprints.

One gallon of the material covers 1500 square feet. Although not a long-term rust preventive, if a permanent type rust-preventive is desired before final packing or storage, it can be applied without removing the neutralizer.

Flodar Fitting Has Steel Fingers Which Grip Tube for Tight Seal



Tube fittings which have unusual construction have been announced by Flodar Corp., Dept. A, 331 Frankfort Ave., Cleveland, Ohio. Known as "Grip Tube," the fitting has a heat-treated steel sleeve, the rear end of which is slotted to form spring fingers. Tightening the nut forces the forward end of the sleeve against the tube flare, sealing the fitting. Further tightening of the nut contracts the segmental fingers of the sleeve around the tube, gripping the tube uniformly. The joint is said to withstand pressures in excess of tube ratings.

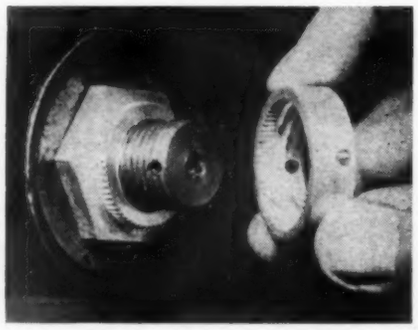
Three Hanna Valves Developed for Use in Air and Hydraulic Control

Three units which are the first part of a new line of valves for air and hydraulic control are announced by Hanna Engineering Works, Dept. A, 1765 Elston Ave., Chicago 22, Ill.

The packless ¼-in. capacity valve called Hanna Unitite Jr. is for tubing and light piping applications. A smaller model of the standard Unitite valve, it is designed for a four-way operation, but may be used as a three-way valve by plugging one port. Pressures up to 250 psi. can be handled.

The foot-operated valve is a packless, effortless control for air and oil hydraulic cylinder application. Two styles have single pedal for constant cycle of operation and split pedal that holds position until tripped. Available in ⅜-, ½-, ¾- and 1-in. sizes, it operates on 250 psi. air pressure or 1,000 psi. oil pressure.

Piston speed is controlled in both directions with the two-direction speed control valve. Adjustable control of inflow and outflow of air or oil to and from one side of the piston is provided. One valve is used for oil operation, while two are recommended for air. Pipe sizes available are ¼, ⅜, ½, ¾ and 1 in. Working pressures are the same as in the foot valve.



60-Station Adjustment Nut Permits Sensitive Setting

A 60-station adjustment nut which permits precision setting is manufactured by E. S. Firestone Engineering Co., Dept. A, 11127 Magnolia Blvd., North Hollywood, Calif. Mating serrations permit the nut to be set at desired tension and locked in position with a cotter-key.

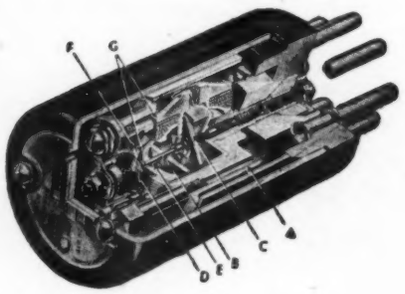
Settings as fine as 0.001 in. on 16-pitch threads are possible, with finer adjustments on threads of finer pitch.

GE Permanent-Magnet Materials Will Fit Wide Variety of Uses

Five new permanent-magnet materials, known as cunico, cunife, vectolite, alnico 12 and silnamal, have been announced by the General Electric Co., Dept. A, Schenectady, N. Y. Cunico is malleable, ductile and machinable; it is an alloy of copper, nickel and cobalt.

Cunife is a copper-nickel-iron alloy similar to cunico except that it has directional properties. Vectolite is said to be the first non-metallic, nonconducting magnet material ever made. It is a hardened, sintered combination of iron rust and cobalt oxide. Vectolite is extremely light.

Alnico 12 is made up of aluminum, nickel, cobalt, iron and titanium. The magnets are cast and must be ground to shape. Silmanal is ductile and malleable.



MAGNETIC RELAY—For operation on currents of thermocouple and photocell magnitudes or other uses requiring dependability under vibration, this relay has shield *A* to protect it from stray magnetic fields. Rotor *B* has small alnico vane *C* at its lower end. Hairspring *D*, balance cross with weights *E*, and contact arm *F* are at the upper end. Magnet vane is positioned between coils *G*. Made by Instrument Div., Thomas A. Edison, Inc., Dept. A, West Orange, N. J.

Shop Equipment News

Potter & Johnston's Automatics Have Many War-Born Improvements

Improvements made in the Model 6DREL automatic chucking and turning machine during the war years have increased productivity and improved flexibility to the point of constituting a new model. Machines of this design, pioneered by the Potter & Johnston Machine Co., Dept. A, Pawtucket, R. I., are fully automatic after manual chucking of the work. Changes of speed and feed and the knock-off when work is completed are automatically performed.

Speed and power is sufficient for carbide tooling. Four automatic changes of spindle speeds, three selective automatic changes of feed, automatic binding of the turret following indexing, and direct cross-slide action are features of the machine.

In the standard model 20 changes of speed between 9 and 167 rpm. are possible, while in the high-speed model the range is 12 to 305 rpm. These speeds are arranged in five sets of four automatic changes which are selected with pick-off gears located in a compartment in the headstock. Automatic spindle stop allows the cutting tools to return to their neutral position without unnecessarily scoring the work.

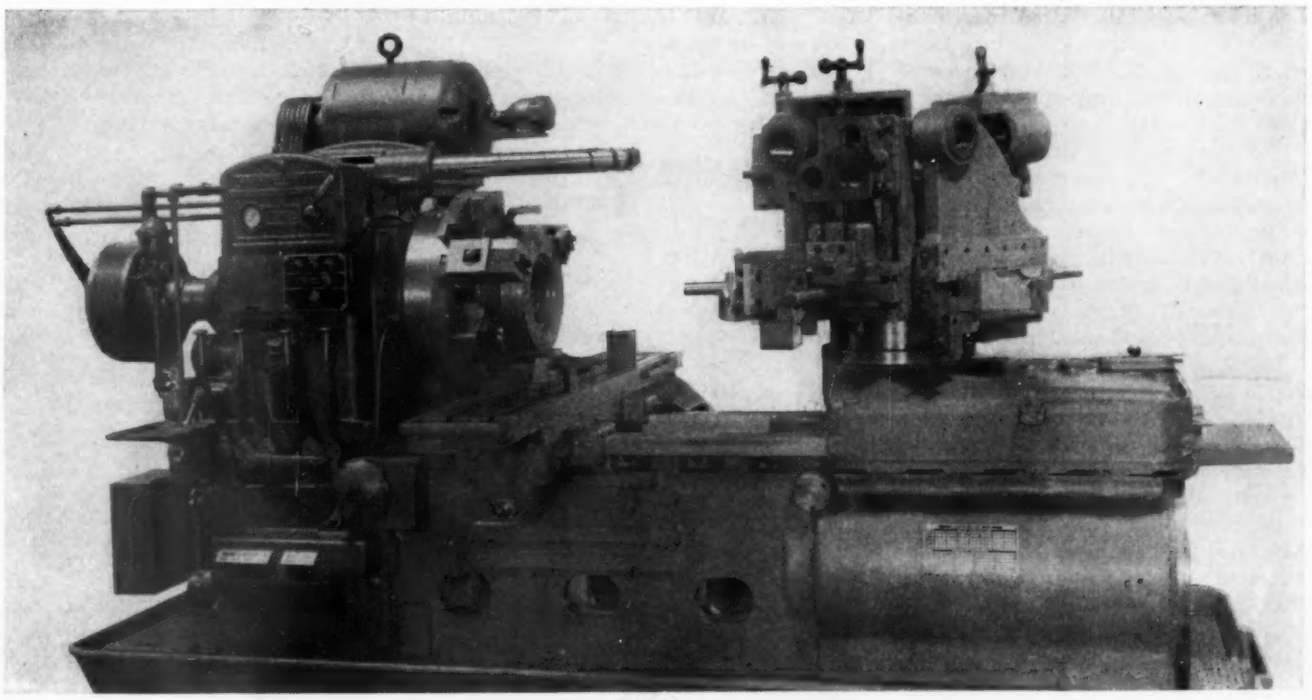
Speed and feed change clutches are provided, which can be operated manually or automatically through dogs. Automatic operation is accomplished by pneumatic cylinders timed by solenoid-operated valves. Speed and feed changes can be made while the machine is under cutting loads.

The feed box provides 24 feeds arranged in geometric progression from 0.007 to 0.089 in. per spindle revolution, or from 0.007 to 0.250 in. per spindle revolution. These feeds are arranged in three groups and one feed from each group may be selected by pick-off gears to set up three automatic feed changes. Fast motion or quick return is operated from a separate constant-speed motor.

Maximum travel of turret slide is 28 in., and minimum distance between spindle nose and turret face 10¼ in. (9¼ in. with heavy-duty cross slides). Model 6DREL has turret feed of 13 in., turret travel to index 25 in. and 10⅛ in. turret slide adjustment.

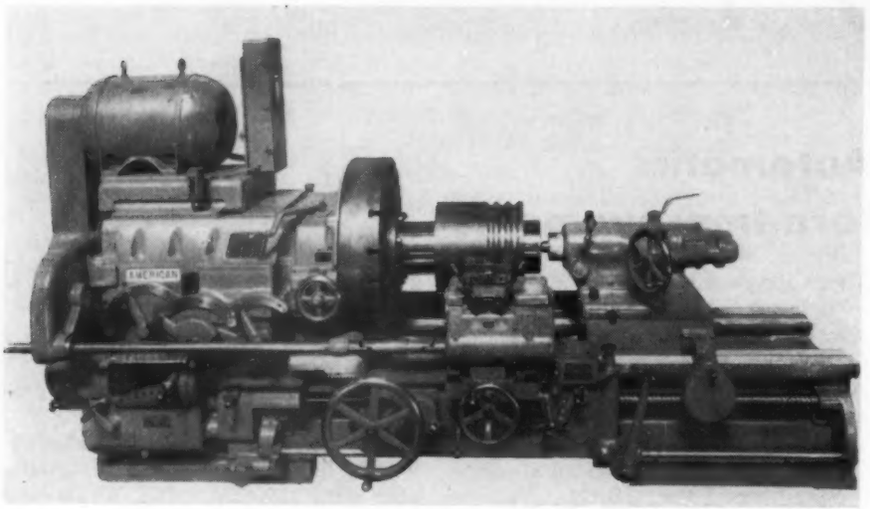
Standard cross slide is 10½ in. wide with a heavy-duty cross slide available with 12½ in. width. The entire cross slide mechanism is fully inclosed and operates in a bath of oil. The unit may be adjusted longitudinally on the base ways by a rack and pinion. Cross slide travel is 8½ in. each way and swing over the slide is 21 in. Swing over the bed is 34½ in.

The timing box transmits power to the turret cam drum and the cross slide cam drum. It maintains a fixed relationship between operation of the cross slide and turret slide throughout the machine cycle. This relationship can be changed by a simple adjustment of the timing mechanism.

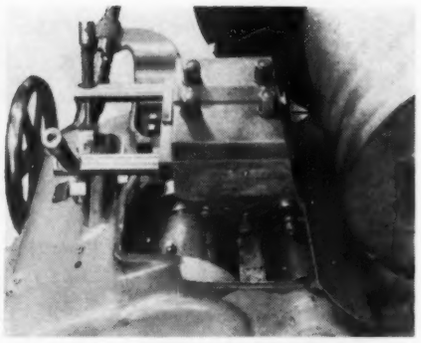


Usually two to four automatic chucking and turning machines may be handled by one operator, determined by the relation of the chucking time to the time cycle required for completion of the work

Irregular Grooves No Problem for American Lathe with Special Rest



42-in. lathe equipped to turn and form irregular groove in forging rolls. Rolls are machined in half sections, with one section at a time bolted directly to turning mandrel



Tools are cam-actuated in this special rest to vary the width and depth of the grooves cut in forging rolls

Irregular grooves are turned and formed in forging rolls on a roll-grooving lathe built by the American Tool Works Co., Dept. A, Pearl St. at Eggleston Ave., Cincinnati 2, Ohio.

A 42-in. Super-Productive lathe is equipped with an especially designed tool rest with cam-actuated tools for simultaneously varying the width and depth of the grooves. An auxiliary spring-positioning mechanism facilitates action of the tool. Drive for the tool rest is taken off of the rear end of the spindle and power is transmitted through a large multiple-splined shaft to the knuckle joint which actuates the tool rest mechanism.

Seven different grooves must be machined from the solid in forging rolls for making automobile axle shafts. The operation requires 26 cutting tools and 50 different cams for the special tool rest.

Hardinge Second-Operation Machine Has Dovetail Bed to Protect Ways

The Model DSM 59 high-speed precision second-operation machine, is announced by Hardinge Bros., Inc., Dept. A, Elmira, N. Y. The new machine is designed for high-speed work to close tolerances.

The steel bedways are of the dovetail design. These ways are ground to master gages after hardening, for accuracy and interchangeability of attachments. The dovetail ways form a solid steel bed top which protects the accurate angular way surfaces from falling chips and foreign matter.

The bed has a three-point mounting to insure accuracy even when the machine is placed on an uneven floor. The spindle is ground to take 1-in. capacity 5C Hardinge collets and 6-in. capacity step chucks. The spindle nose is supplied either with standard taper nose or threaded nose for direct application of step chuck closers, jaw chucks, and face plates.

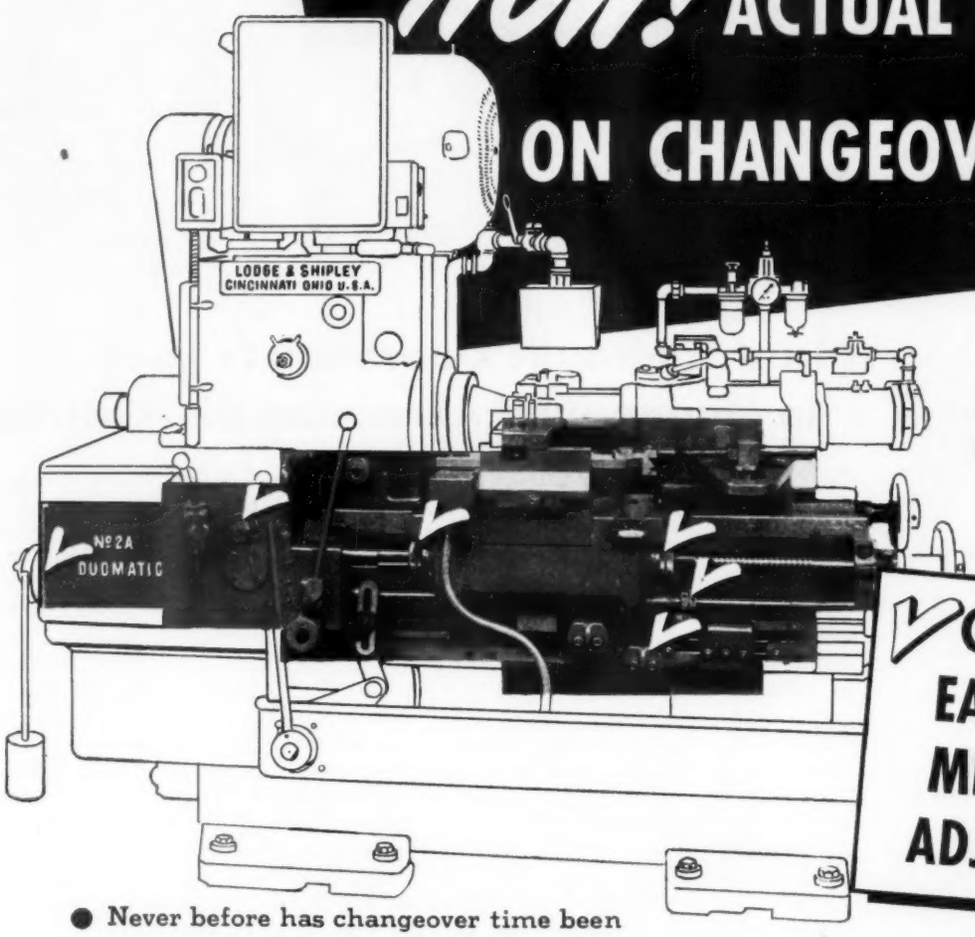
The double-tool cross slide has a constant full bearing on the base for ridigity when taking heavy cuts. The toolposts take standard ⅜-in. square toolbits but they can be removed and No. 00 circular form tools and holders used. Straight or tapered turning slide can be used.

Preloaded ball bearings are used in the turret head to eliminate play between the head and slide. To eliminate radial play, the index pin is mounted on preloaded roller bearings. This combination gives a new accuracy for turret work. The head is bored to take standard ⅝-in. shank tools.

Coolant facilities are included. The base, which is arranged to provide adequate leg room, incloses the driving unit and tool compartment.

Arrow indicates the hardened and ground steel dovetail bed on this new Hardinge second-operation machine

NOW! ACTUAL PROFITS ON CHANGEOVER TIME



WITH THE "JOB SHOP" DUOMATIC

✓CHECK THESE EASY, RAPID MECHANICAL ADJUSTMENTS

● Never before has changeover time been cut so sharply. For example, to set-up and run 500 small shafts on an engine lathe required 55 hours. On the 2A Duomatic, the same number of pieces were set-up and run in only 18 hours. 37 HOURS SAVED!

Handle universal work, make unbelievably fast savings in changeover time and production with the 2A Duomatic. There are no cams. Simple, mechanical adjustments (note arrows) eliminate costly, time-wasting cam changes. This "Job-Shop Automatic" performs in minutes work taking hours on engine lathes.

Whether your runs are long or short—50 or 5000 pieces—the 2A Duomatic makes your profits bigger. And you profit further because responsibility is built into the lathe—any unskilled operator can handle the most complex mutiple tool jobs with ease.

For detailed information of the 2A Duomatic (for small jobs) and the 3A Duomatic (for larger work) write on your company letterhead for Bulletins 601 and 620.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

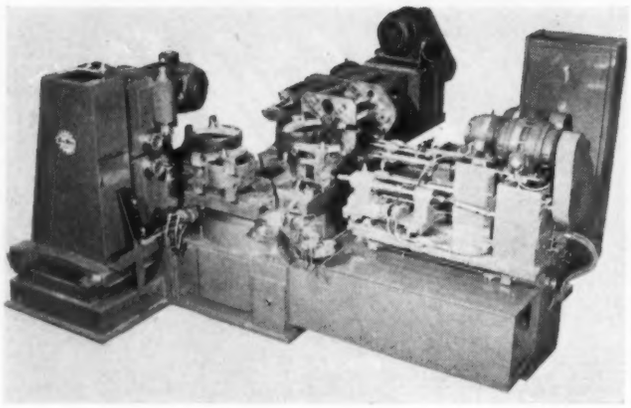
L & S LATHES

Special Machine for Motor Frames Takes 12 Sizes by Simple Changes

Milling, drilling and tapping operations are combined in a four-station indexing machine designed and built by the Davis & Thompson Co., Dept. A, Milwaukee 14, Wis. These operations are performed simultaneously on electric motor frames. Interchangeable fixture and drill plates make it possible to change over from one size motor frame to another in a short time, 12 sizes being handled altogether.

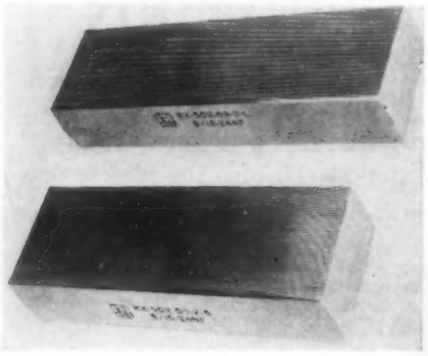
Of the four stations, the first is for loading. At the second station milling the base of pads and milling to width is performed. At the third station four mounting holes, four conduit box holes, central setscrew hole, and bottom conduit pipe hole are drilled. At the fourth station, four conduit holes, center setscrew hole, and bottom conduit pipe hole are tapped.

A hydraulic motor through worm and worm wheel indexes the table. All heads being electrically interlocked must be in the starting position before the cycle can begin. Weight of the machine is 51,500 lb.



Electric motor frames in a number of sizes are accommodated by changing fixture and drill plates on this automatic four-station machine

Shims Eliminated in Thread Dies Introduced by Jones & Lamson Co.



Ground-thread flat rolling dies have been introduced by the Jones & Lamson Machine Co., Dept. A, Springfield, Vt. For use on Waterbury Farrell, Manville, National Bolt Maker, and National Electric Jr. and Sr. thread-rolling machines, these dies are available in lengths to 10 in. and widths to 8 in.

A standard type of starting and leaving end has been established for the short die. All dies are matched, and the elimination of shims speeds up setup time. Even distribution of rolling pressure is assured, and die life is said to be increased on both soft and heat-treated materials.

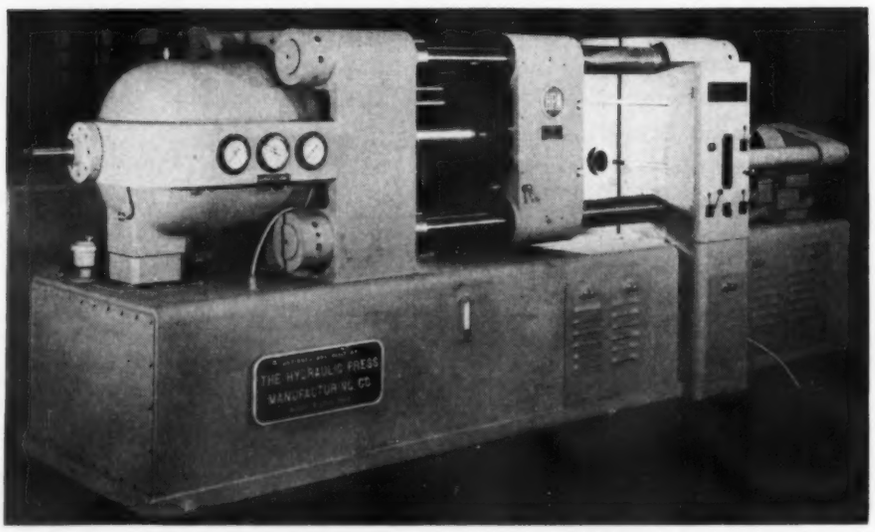
Direct Hydraulic Operation Is Used In Magnesium, Aluminum Die-Casting

Two high-pressure die-casting machines for casting magnesium, aluminum, and copper alloys, have been developed by the Hydraulic Press Manufacturing Company, Dept. A, Mt. Gilead, Ohio. These machines have mold clamping, metal injecting, core pulling and ejecting units all operated by direct hydraulic means.

The cold-chamber process is employed with metal sustained in the molten state in a holding furnace. Metal is ladeled into a slot opening into the injection cylinder. The injection plunger advances, displacing the metal in the cylinder.

The machines have injection capacities from 12½ to 100 cu. in. per cycle. Injection pressures from 6,000 to 50,000 psi. are available, depending upon plunger diameters. The two standard models are the 400-A for aluminum and the 400-M for magnesium. On the magnesium machine, the plunger is actuated by a nitrogen accumulator or "bottle," providing injection speeds up to 7,200 in. per min. Since the injection speed is adjustable, this machine can also be used for die-casting other alloys. The standard aluminum machine employs straight-line hydraulics, with a maximum injection speed of 750 in. per min.

The mold halves are sealed during injection by a straight-line hydraulic clamp. The double-acting main ram is equipped with a small internal booster ram which provides for rapid advance of the movable mold half. Just prior to mold contact, closing speed is reduced, eliminating slam of the mold halves. The clamp pressure, clamp stroke, and position of the slow-down are all adjustable.



Each cycle on this hydraulic die-casting machine is automatic. The cycle is started by the operator with an electrical foot switch

American Develops

Special Testing Machines and Methods

to insure that you get

AMERICAN PHILLIPS SCREWS

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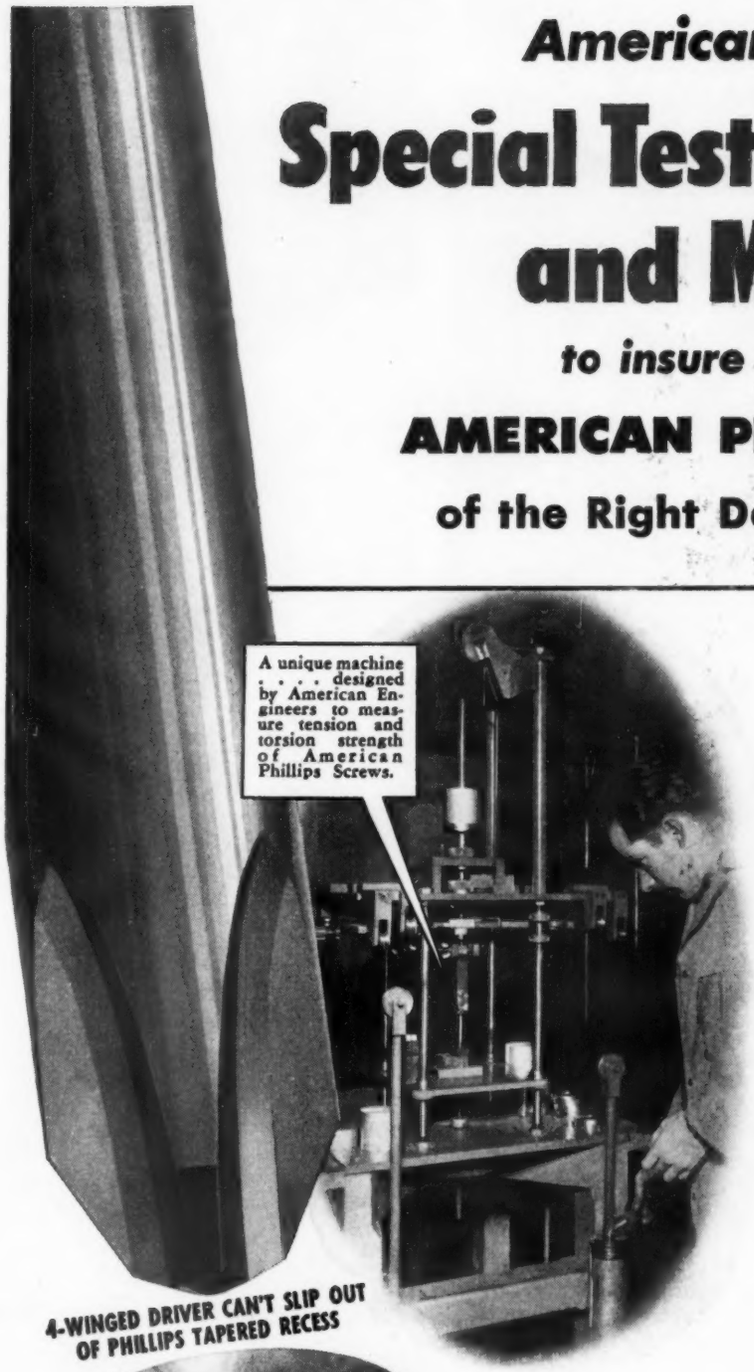

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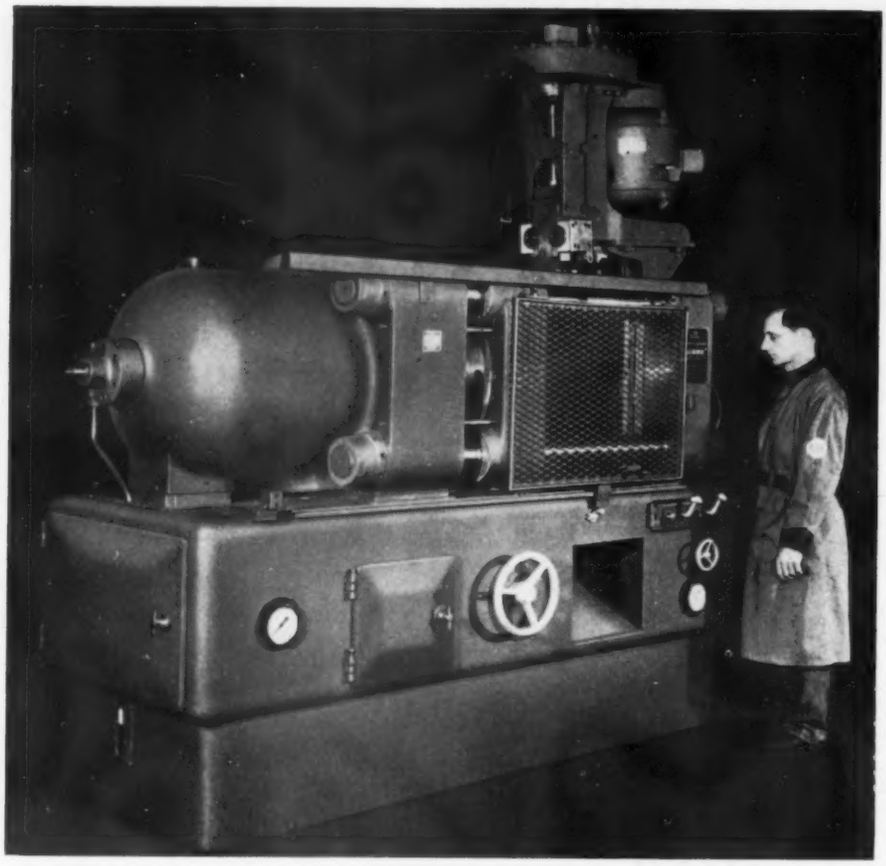
Production Molding of Rubber Speeded in H-P-M Turbojector



Mechanical parts of natural and synthetic rubber are produced by injecting rubber into a hydraulically clamped mold. Rubber bushings were molded in one setup, 100 per cycle, with an injection capacity of 2½ lb., and cure time of only 1½ min. up to 8 lb. of rubber has been molded per shot

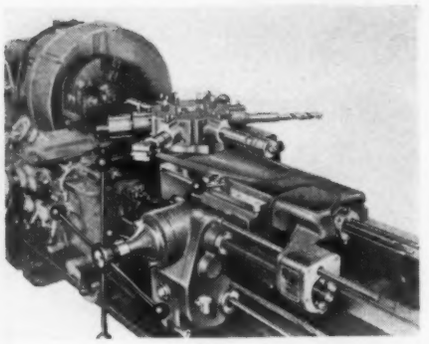
The Turbojector, a machine for production molding of both natural and synthetic rubber, is announced by the Hydraulic Press Mfg. Co., Dept. A, Mount Gilead, Ohio. By means of a motor-driven screw, rubber is injected into a hydraulically clamped mold. The entire machine cycle is automatic. Pumps and valves for controlling hydraulic action are in the machine base.

Preforms are eliminated and curing time tends to be substantially reduced, in some cases as much as 93% according to the manufacturer. Flash is eliminated, reducing finishing operation.

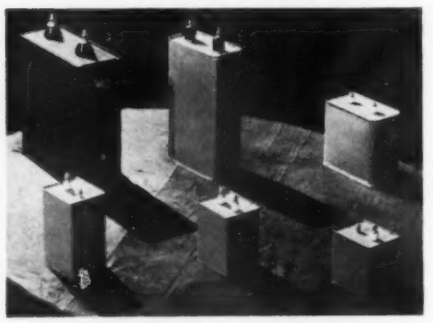
The driving mechanism of the injection unit consists of a 10-hp., 4-speed electric motor and train of gears, direct-connected to the injection screw. The rubber in strips, pellets, ribbons, or rod form is fed into the injection cylinder by the feed screw. As the rubber advances, the feed screw meshes with a set of specially designed, free-running baffle gears, which act as pressure locks. Action of the screw and baffle gears forces the rubber into the nozzle. The frictional heat produced in the injection chamber raises the temperature of the rubber as high as 300 F. Additional heat is secured at the nozzle by employing an electric resistance fan heater. This preheating is said to account for the rapid curing cycles which can be obtained. Maximum nozzle contact pressure during injection is approximately 6,000 lb., permitting injection pressures as high as 18,000 psi. on the material to be molded. Experimentally the machine has molded up to 8 lb. of rubber per shot.

Axelson Ram-Type Turret Made To Fit Standard 20-in. Lathe

A ram-type turret to fit its standard 20-in. lathe is announced by Axelson Mfg. Co., Dept. A, Box 98, Vernon Station, Los Angeles, Calif. Of heavy-duty design, the turret will handle any work within the capacity of the lathe. It is available with either hand or power feeds. Leadscrew threading is also available with the power feed. An automatic reverse clutch in the apron causes the ram to feed in the right direction regardless of direction of feed-rod rotation. The six-station turret rotates on tapered roller bearings and is automatically indexed and clamped.



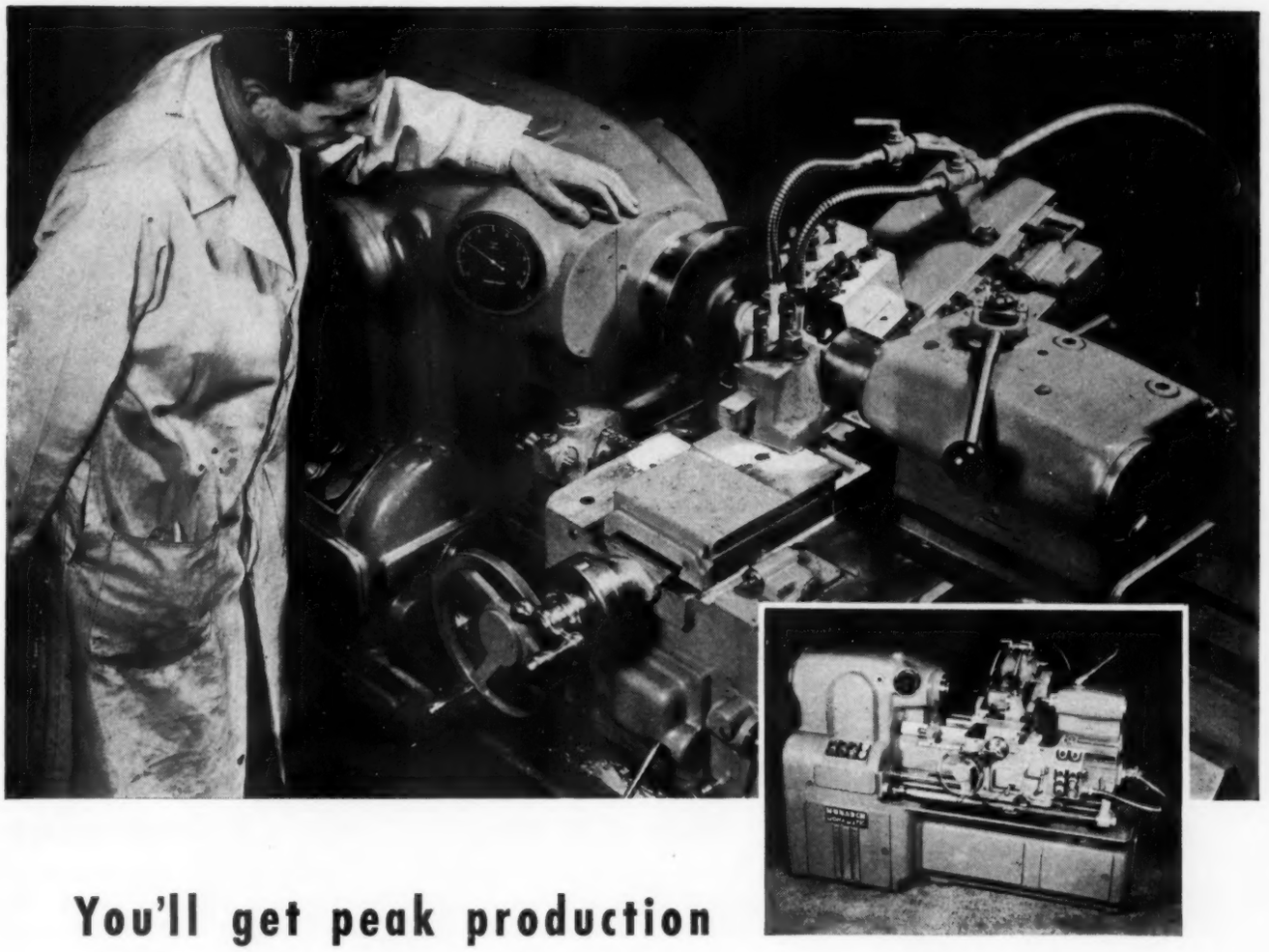
The leadscrew threading attachment takes off from the apron gearing and has interchangeable leadscrews and nuts which can be changed with a minimum of tools and without the necessity of dismantling any mechanism. Either right-hand or left-hand threads can be cut by reversing the lathe spindle.



CAPACITORS—For light-metal welders, a line of small dc. Pyranol capacitors has been announced by the General Electric Co., Dept. A, Schenectady 5, N. Y. They are available in a wide range of ratings, with ambient temperature operating limits from 0 to 50 C.

Stokes Plastic Molding Press Has Full Automatic Operation

A completely automatic hydraulic machine of 50-ton capacity for plastic molding has been developed by the F. J. Stokes Machine Co., Dept. A, 5935 Tabor Road, Philadelphia 20, Pa. The automatic cycle controller is simply set by changing the position of buttons on various bars. An elec-



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Fully automatic cycle—or fully manual—or any combination. Between-centers work as fast as carbide tools and modern metals can take it—spindle speeds up to 1000, 2000, 3000 and even 5000 RPM.

That's the kind of work you can do on the Mona-Matic. Regardless of exacting tolerance requirements, you'll get floor-to-floor time you'd ordinarily think of only in connection with specialized one-purpose machines—and at the corresponding low machining costs usually restricted to mass production methods.

Yet with the Mona-Matic you'll have an almost universally adaptable machine—one you can use on big lots and small, year in and year out. The front carriage is built with power feed and rapid traverse return; the independent electrically controlled rear slide may be added as a separate unit.

* **MONA-MATIC** — Add this new name to your metal-turning dictionary — You'll be hearing a lot of it — wherever rising production costs are a factor. The *Mona-Matic* is Monarch's answer to this problem in the field of between-centers work. For chucking and fixture work it's the *Uni-Matic*; for hand screw machine work the *Speed-Matic*.

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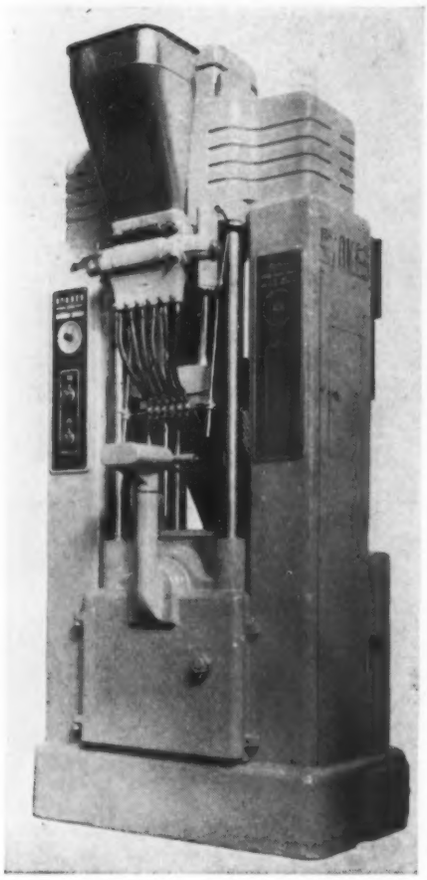
Monarch

TURNING MACHINES

tric timer governs any period of cure up to 5 min. A super-sensitive trap checks every molded piece. Any irregularity stops the press and rings an alarm bell to call the operator to the machine.



This plastic molding machine can be operated automatically or, when used for insert work, semi-automatically with pushbutton control. The cycle control is in the right side of the machine, is adjusted by positioning buttons on vertical bars

The press opens and closes at the rate of 100 in. per min. when in the clear and has final closing speed adjustable from 8 to 0 in. per min.

The air push-off is actuated by a separate bar in the controller. It combines both mechanical and compressed air action to eject the molding and clear the mold. If desired, air alone may be used.

The machine has a maximum stroke of 14 in., and a maximum capacity in each of the six feed chambers of 4 cu. in. When operated as an automatic machine it is only necessary to keep the hoppers filled and to remove the accumulation of molded pieces. One operator can handle a large battery of presses.

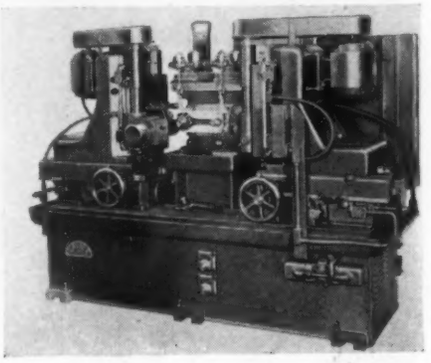
Connecting Rods Weighed, Milled With Snyder's Balancing Machine

A special machine for balancing connecting rods which weighs the part, then mills it for balance has been developed by Snyder Tool & Engineering Co., Dept. A, 3400 E. Lafayette St., Detroit 7, Mich.

The connecting rod is placed in a fixture attached to two scales which register the amount of overweight at either end of the rod. Positive end stops for the depth of cut are adjusted by means of handwheels on which the reading is set to correspond with the readings on the two scales. With this adjustment set, the cycle starter button is pressed and the machine goes through its cycle automatically.

In this cycle, the part is clamped in the fixture, milling units advance rapidly against their adjusted solid stops then feed through the work. Cutters pull away from the work and return to starting position. Clamps release automatically and the workpiece hangs freely on the scale rods, giving the operator an immediate check on the accuracy of the cutting operation just completed.

The machine will take a variety of connecting rods varying from 7 to 13 in. in length. This is accomplished by making one scale movable and providing a fixture adapter.

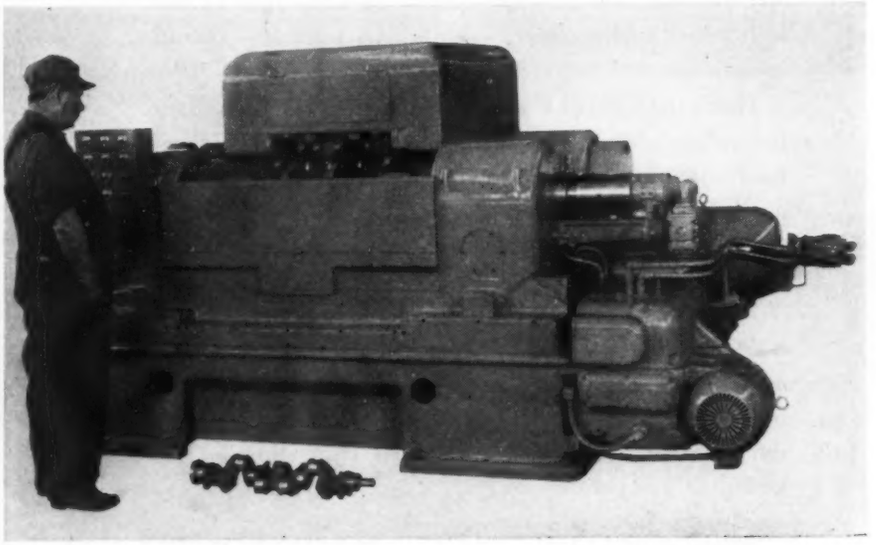


Wickes Crankpin Turning Machine Has Automatic Cycle of Operation

A single-spindle machine for turning all crank pins on multiple-throw crankshafts is produced by Wickes Bros., Dept. A, Saginaw, Mich. The Model MP-4 can be used for either cheeking and rough turning or finish turning, spacing, and filleting.

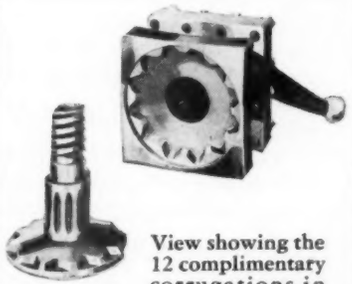
Tool feed is hydraulic and the lathe is completely automatic through each cycle. A cam-operated synchronized variable speed and feed mechanism maintains both the lineal cutting speed and feed per revolution at the maximum permissible during the cycle. A transfer switch permits the operator to jog the spindle or jog the carriage for setup purposes.

Tool holders are of the roller-supported type. Hydraulically operated pot chucks hold and drive the crankshaft from each end. Weight of the machine, which is suitable for all automotive-type crankshafts, is approximately 30,000 lb.



Hydraulically operated steady rest support the crankshaft when necessary in this automatic multiple crankpin turning lathe

# of McCROSKY *Turret* TOOL POSTS



View showing the 12 complimentary corrugations in the turret column and body—an exclusive McCrosky feature—that assures accurate indexing to extremely close limits and provides the rigidity needed for heavy cuts.

● Featuring a service proved design, conceived, perfected, and available only from McCrosky, TURRET Tool Posts permit successive tools to be swung into cutting position easily, quickly, and accurately, without stopping the machine for tool changes. They speed up production, and give engine lathes the versatility of turret lathes. The indexing corrugations on the post and body with their long shore line of contact are finished to extremely close tolerance on specially built machines. This construction provides the extreme rigidity needed to withstand the thrust of the cut—minimizes wear—and assures accurate indexing within the close limits required for repetitive work.

McCrosky TURRET Tool Posts are endorsed by all well known lathe manufacturers,— and are used extensively by leading concerns from coast to coast. Furnished in five styles including square and hexagon designs,— nine different sizes. Write for Bulletin No. 16-E. It gives full details.

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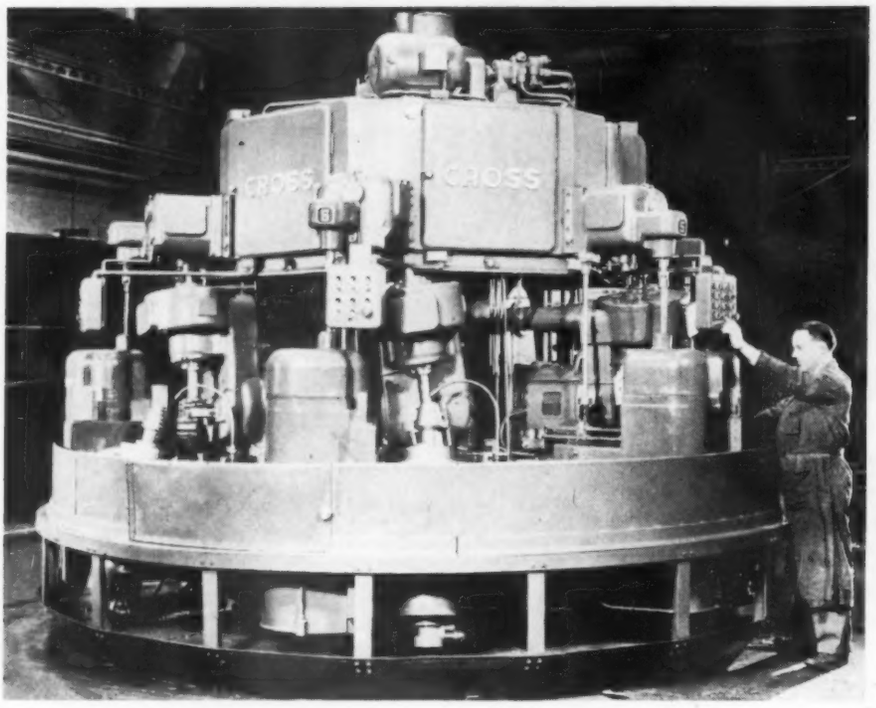
Designers and Manufacturers of

Jack-Lock Milling Cutters — *Super Adjustable* Reamers

Block Type Boring Bars — *Turret* Tool Posts

Wizard Quick-Change Chucks — *Special* Multiple Operation Tools

Taper Threads Milled on Machine with 6 Independent Work Stations



Each station completes milling operation in one revolution of the bed. Operator reloads each station as it passes his position

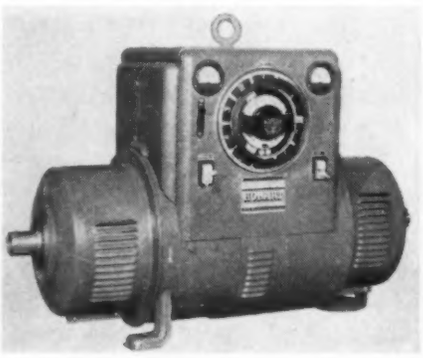
Taper threads are milled on 19 different models of oil drill cutters in a special machine designed and built by the Cross Co., Dept. A, Detroit 7, Mich. Six self-contained, independent work stations are mounted on a circular bed with variable rotary feed. The feed is timed so that each station automatically completes the milling on one piece of work during one revolution of the bed. All the operator has to do is unload and reload the pieces as the stations pass him. He pushes a button to repeat the cycle.

The motor-driven milling head quick-approaches to cutting position. With the cutter turning, the workhead spindle spiral-feeds the piece upward into the cutter. Upon completion of the cut, the milling head moves back to idle position, and the workhead lowers while the spindle reverses.

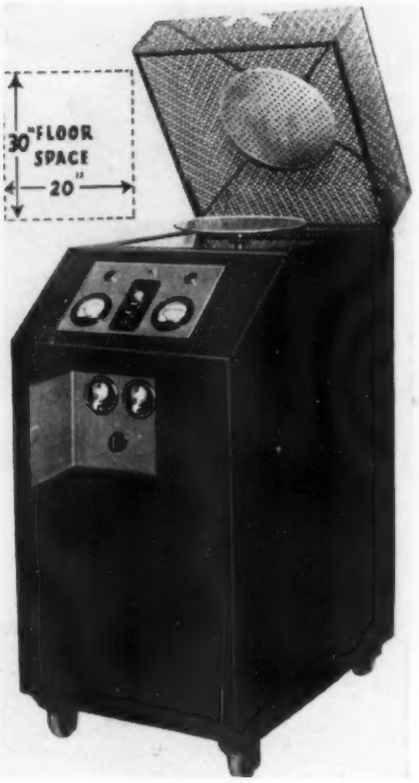
Hobart Synchronous Motor Welder Has Separate Exciter Built In

A compact, high performing synchronous motor welder, which utilizes an in-built separate exciter is produced by Hobart Bros. Co., Dept. A, Troy, Ohio. The unit is so proportioned that it can be started across the line and automatically synchronizes itself by the build-up of the separate exciter. Starting current is about the same as a conventional induction motor of the same capacity.

The motor is a revolving-field synchronous type. A heavy squirrel-cage winding makes easy starting as a conventional induction motor. Once up to speed the exciter builds-up and automatically applies correct excitation to motor fields.



The machine can also be used as an ac. generator for the operation of small tools. This is done by coupling the shaft to a gasoline or electric motor and the synchronous motor then becomes an ac. generator.



6 Lb. Brought to Molding Heat In a Minute with Thermall Unit

A high-frequency heating unit, the Thermall "Champ" which will heat 6 lb. of material to molding temperature in one minute, is announced by W. T. La Rose & Associates, Dept. A, Troy, N. Y. Automatic electric time control has intervals from 0 to 3 min. by seconds. Compounds requiring different time cycles may be heated simultaneously.

Preforms or powder are fully visible while heating. The unit weighs 500 lb and is mounted on rubber-wheel casters.

Small Parts Cleaned in Baskets With Detrex Two-Dip Degreaser

A new two-dip immersion vapor degreaser for cleaning small parts has been introduced by Detrex Corp., Dept. A, Detroit 27, Mich. Parts are placed in baskets which are loaded at one end of the degreaser, carried through the cleaning cycle, returned to the same end for unloading.

A choice of several cleaning cycles is possible. With the immersion-vapor cycle, work is dipped in hot solvents in the first chamber, and then is moved through vapor in the second. With the vapor - immersion - vapor cycle, the solvent level is held low in the first chamber allowing the ac-

Over One Million feet of precision threads with just six cutters!

Part: Large adaptor plug.
Material: SAE 1035.
Thread Diam.: 4" and 6⅜" on each piece.
No. of Threads: 8 and 10 respectively. (12 pitch)
Tolerance: ± 0.005 in. (on pitch diameter)
Quantity: 50,000 pieces.
Output: 15 parts per hr. per machine. (16 hrs/day)
Tools Required for Run: Only 6 "Detroit" thread milling cutters.
Average No. of Grinds: 18 per Cutter.
Stock Removed per Grind: .015 to .020 in.

Those are cold figures but to the tool engineer and production man they tell a real cost-saving story—the kind of performance needed today to keep costs down—the kind of performance "Detroit" thread milling cutters are giving day in and day out.

Those "Detroit" cutters were just as good as new even after 18 sharpenings apiece.

What's more, "Detroit" thread milling cutters are easy to order. Most widely used types and sizes are even carried in stock, ready for thread grinding to your specs.

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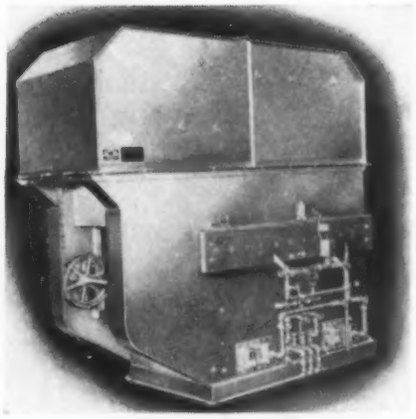
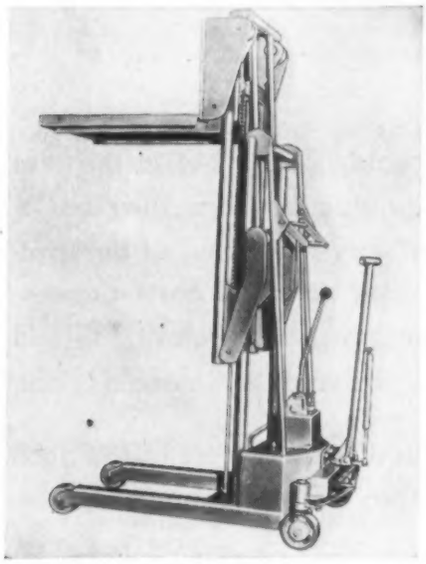


cumulation of oils and grease. The conveyor moves through hot solvent in the second chamber and then through solvent vapors in the final phase. The boil-rinse-vapor cycle cleans the work in solvent at a boil temperature, then at a rinse temperature, and finally in vapor. If desired, vapor alone can be used. Up to 180 baskets of parts are cleaned per hour.

Telescopic Frame Adds Height To Lyon-Raymond Lift Truck

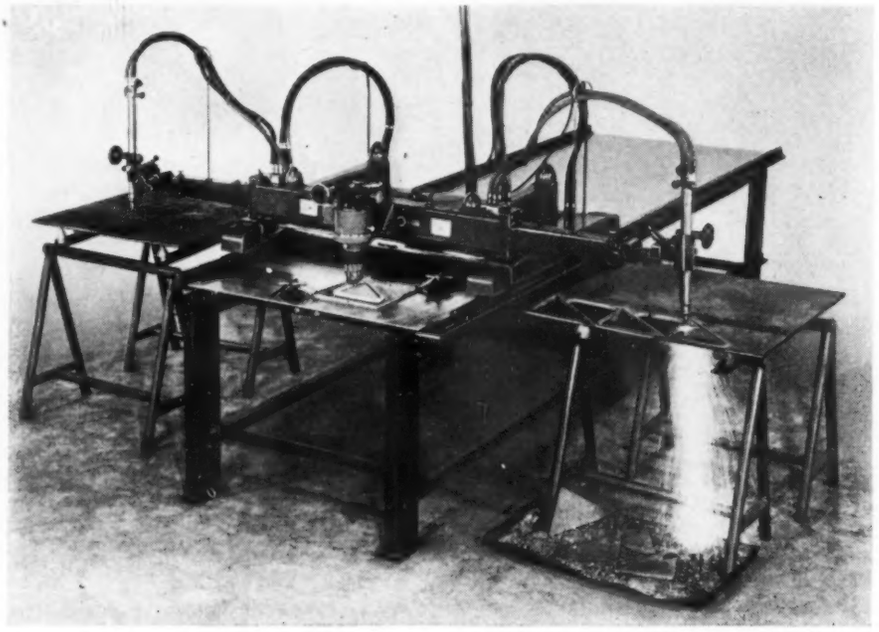


A telescopic frame which adapts the High-Lift truck to higher stacking and tiering jobs has been developed by the Lyon-Raymond Corp., Dept. A, 2671 Madison St., Greene, N. Y. It increases the elevated height of the platform from 48 in. to 84 in. In lowered position the over-all height of 69 in. is maintained, allowing the truck to be moved through doorways and under overhead obstructions. The telescopic section is of the same tubular construction as the base frame. It can be equipped with either hand pump or motor-driven pump.

Dual Shape Cutting Is Possible On Oxweld of Intermediate Size

A machine designed to do precision cutting on work of intermediate size, the Oxweld CM-15-36, has been announced by The Linde Air Products Co., unit of Union Carbide and Carbon Corp., Dept. A, 30 E. 42nd St., New York, N. Y. A new attachment makes it possible to mount blowpipes on both sides of the tracing table, permitting the cutting of identical shapes from plates on both sides of the tracing table or cutting on one side while plates are put into position on the other.

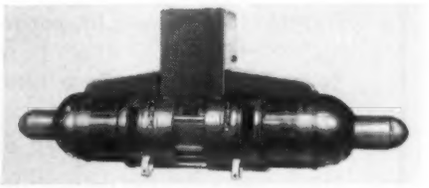
All types of shape-cutting performed with larger machines are possible within the 36-in. transverse working range of this machine. The longitudinal working range with the standard table is 100 in., but this range can be extended idefinitely by adding frame and table top sections. The carriage is made of cast aluminum to provide light weight and rigidity. A flat aluminum plate supported on the frame between rails of the track serves as a table surface upon which the drawing or templet to be traced is placed. The machine is equipped for either mechanical tracing with strip templet or hand-tracing. A magnetic tracing unit is available as an accessory for use when maximum precision in repetitive production shape-cutting is desired.



Cutting gusset plates on the CM-15-36 shape-cutting machine. Straightline cutting guides and a circle-cutting attachment are supplied

One Motor for Parallel Welder Used With Lincolnweld Process

A 1200-amp. welder comprising two 600 amp. generators, close-coupled to an ac. induction motor and equipped with complete motor control is announced by The Lincoln Electric Co., Dept. A, Cleveland, Ohio, for use with the Lincolnweld automatic metallic shielded arc-welding process. Output leads of the generator are paralleled in the control box by means of copper jumpers between studs of like polarity. With the jumper removed and the electrode lead connected to only one of the output studs, welding currents can be obtained which are half those obtained from parallel operation. Output is varied by means of a field rheostat with either single or parallel operation.



Since both generators are excited from the same exciter, controlled from the same rheostat, and driven from the same motor, the usual problems of parallel operation are not present. Since they are used only for automatic welding, control is simple compared to that for manual welders which must provide a variety of arcs. Designated SA-1200, this welder weighs 3,200 lb.

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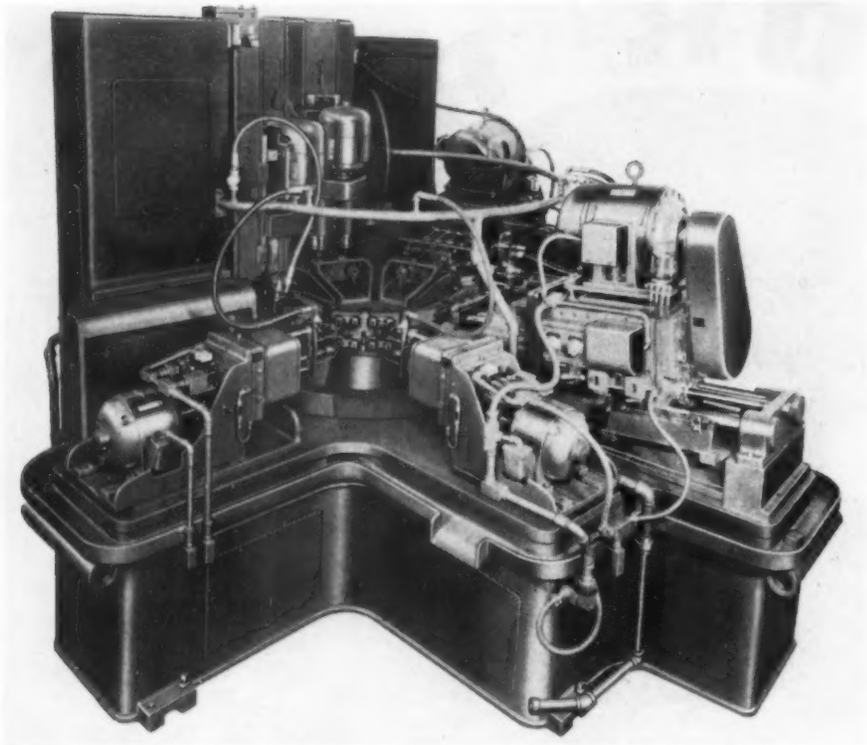
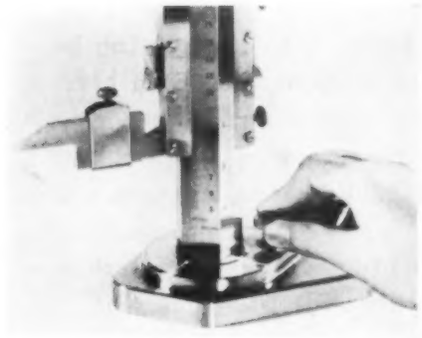


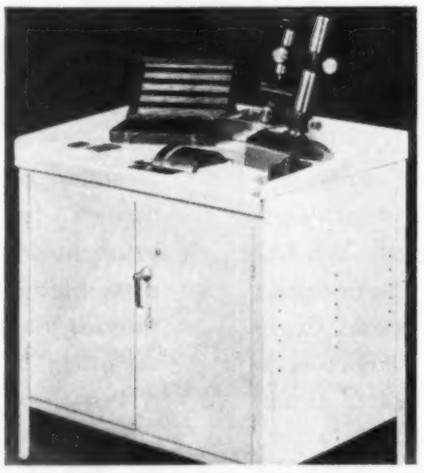
STEERING KNUCKLE—Each fixture on this seven-station machine clamps a left- and right-steering knuckle. Operations performed are drilling, reaming, tapping, and two-way rough and finish boring, as the parts progress around the machine. Built by Snyder Tool & Engineering Co., Dept. A, 3400 E. Lafayette St., Detroit 7, Mich., the machine has an estimated production of 200 parts per hour

George Scherr's Height Gage Has Unusually Large Vernier



An extra large vernier is used on the new 48-in. Chesterman height gage built by George Scherr Co., Inc., Dept. A, 200 Lafayette St., New York 12, N. Y. The vernier is 2.450 in. long, compared with the ⅝ in. vernier commonly used. Readings may be made without removing the gage from the work and holding it up to the eye.

Quick adjustment of the gage is obtained by simply pressing two lugs along the heavy triangular beam. The fine adjustment is mounted in the base so that downward pressure on the screw will not cause tilting or moving of the gage.



Finish to 2 Microinches Obtained With Centerless Lapping Machine

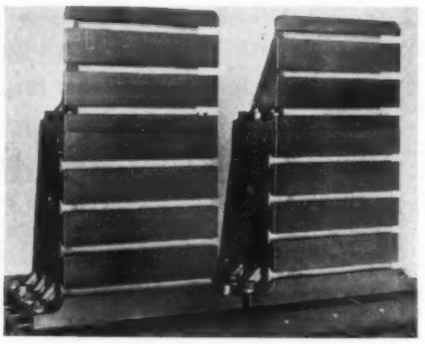
The Model 100 centerless lapping machine is announced by Size Control Co., Div. American Machine & Gage Co., Dept. A, 4636 W. Fulton St., Chicago 44, Ill. A precision finish of less than 2 microinches is easily obtained on this machine and lapping time is greatly reduced. A variety of cylindrical work can be lapped with no setup time involved. The machine has a ½-hp. motor and vibrationless drive built in.

Viking Tool's Hand Tapping Unit Has Arm That Is Easily Adjusted

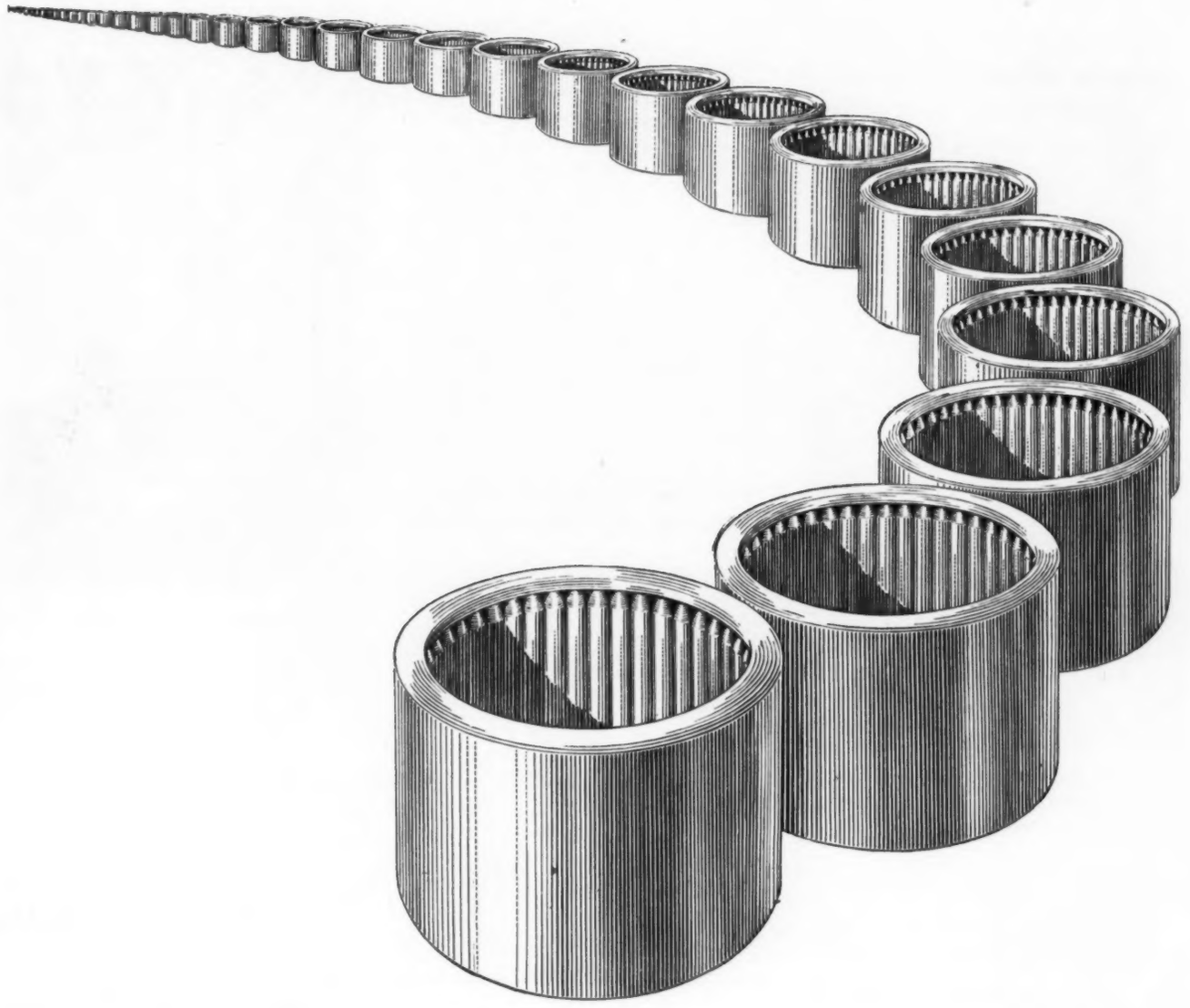
A hand tapper with adjustable arm is announced by the Viking Tool & Machine Corp., Dept. A, 10 Main St., Belleville 9, N. J. Easily raised or lowered, and swung to right or left, the arm adjustment increases flexibility and reduces amount of resetting.

Work up to 18 in. in height can be handled. Sliding parallel bars hold work in place. Quick changing adapters permit changing taps in 5 sec. and are available in sizes from ¼ to ⅞ in.

DeVlieg Matched Angle Blocks Are Combined in Various Ways



Matched angle blocks which can be combined for accurately locating and chucking work have been announced by the DeVlieg Machine Co., Dept. A, 450 Fair Ave., Ferndale 20, Mich. Machined from box section castings with T-slots and flat surfaces in precise alignment, the units can be used singly or in combination for boring, milling, planing, or other purposes.



They're cutting operating costs all along the line

Economy of operation is an inherent feature of Torrington Needle Bearings, and it shows up in the form of measurable cost savings all down the line. . . .

In power costs . . . The tremendous radial capacity of Needle Bearings, combined with their low coefficient of friction and equalized load distribution at operating speeds, assures minimum starting and running friction . . . less power consumption.

In lubrication costs . . . The close-fitting, turned-in lips of the hardened outer shell form a reservoir to retain the lubricant and distribute it evenly over all of the bearing surfaces. Thus, less frequent lubrication and maintenance are required, and bearing wear is reduced to the vanishing point.

In servicing or replacement costs . . . Needle Bearings also contribute marked economies. They never seem to need attention, seldom if ever is a replacement required. This is due directly to their design, high load capacity and efficient lubrication.

In your own industry, compact, low-cost Torrington Needle Bearings have solved innumerable friction problems. Our Catalog 32, copy of which is available upon request, will give you a comprehensive picture of Needle Bearing advantages as applied to the machines *you* design, build or operate.

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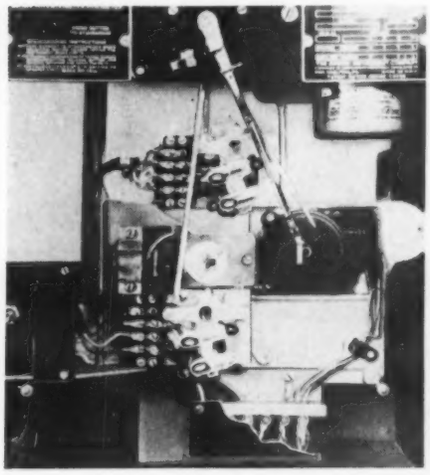
TORRINGTON NEEDLE BEARINGS

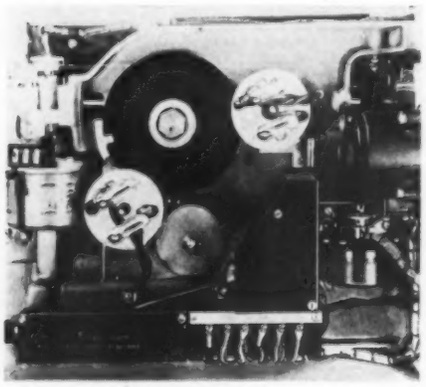
Continuous Balance Attained In Brown Electronic Devices

High quality control through continuous balance, rather than intermittent action, is a feature of several new electronic control instruments made by Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Dept. A, Philadelphia, Pa.



Circular chart electronic with chart plate removed showing front-set mercury switch control mechanism

Front-set mercury switch circular chart controllers permit control of heat input simultaneously with changes in process temperature, practically eliminating instrument lag. The control mechanism consists of from 1 to 4 single-pole, single-throw mercury switches which are operated through a differential linkage between the pen shaft and control index. The control index may be set to any position between 0 and 100% of the chart span of the instrument.

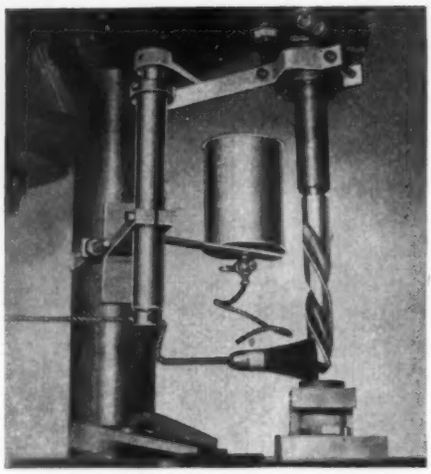


Strip chart electronic showing mercury-type auxiliary switches on rear of chassis

Back-set mercury-type auxiliary switches for both circular and strip chart electronic potentiometers have a capacity of 1 amp. at 115 v. or ½ amp. at 230 v. These switches are used primarily to supplement basic control functions, either pneumatic or electric, by providing means to operate alarms or safety devices, and sometimes to initiate other process steps upon the attainment of present temperature conditions.

A feature of the instrument is that if an open-circuit develops in the thermocouple, the extension leads, the input transformer, or if the converter or voltage amplifier tube fails, the instrument pen moves sharply upscale shutting off the heat supply.

Lubro-Brush Cleans, Lubricates; Operated by Drill-Press Spindle

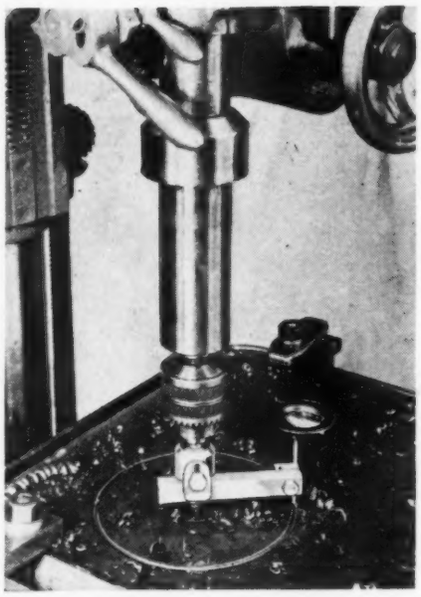


A device which automatically lubricates and brushes tools, the Lubro-Brush, has been developed by the Charles L. Jarvis Co., Dept. A, Middletown, Conn. A cam-action in the vertical tube of the unit transfers a short lift of the drill-press spindle into a sweeping action of the brush. When the drill is raised the brush cleans and oils the drill. On the down stroke the brush swings to one side where it receives a few drops of oil for the next sweep.

The unit will fit any standard drill press and can be adapted to other devices, such as punch presses, small lathes, and hand millers.

New Bruno Circle-Cutting Tool Has Holder Permitting Tool Yield

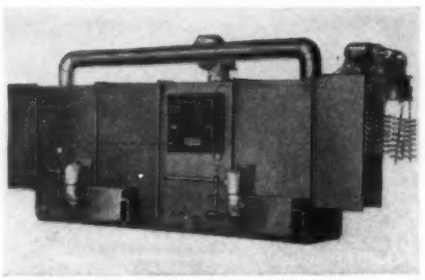
A new adjustable hole-cutting tool is announced by Bruno Tools, Dept. A, Beverly Hills, Calif. The tool cuts smooth large-size holes in wood, steel, brass, hard rubber, aluminum, plastics and other materials. Diameters can be varied from 1⅞ to 8 in. through ¼ in. thickness in steel or other tough



materials and 1½ in. thickness in plastics and similar materials.

The cutter consists of a combination drill and pilot with an improved high-speed cutting blade, adjustable to depth and diameter. The Wedge-Lok cutting blade holder permits cutting edge to recede or yield from work while still maintaining steady pressure and feed.

Racks Hold Parts in Optimus Continuous Washing Machine



As many as 60 racks of parts per hour can be cleaned in this machine which uses an overhead chain conveyor

A continuous-type washing machine for handling large numbers of metal parts on racks has been introduced by Optimus Equipment Co., Dept. A 151 Church St., Matawan, N. J. Any type of parts can be handled provided they are free-draining and the sprays have free access to the parts.

The machine can be used as a single-stage washer, or for a number of successive operations. A number of manifolds with spraying nozzles are mounted on all sides of the washing chamber. If an acid solution is used, the machine is furnished built of acid-proof material.

PUTTING a true radius in the bottom of a ball socket creates none of the usual headaches when the job is done with a Nicholson Ball Shape Rotary File operated in a power drill press. Deep sockets (right) or shallow ones (left)—it makes no difference, because Nicholson Rotaries are perfectly rounded and true centered. They won't wobble; they won't "chatter" as a result of uneven cutting or grinding. They work with high efficiency in drill press, portable power tool, or flexible shaft.

Nicholson Rotary Files represent the highest standards of precision and quality. The Hand Cut types reflect many years of file-cutting skill; and the Ground types are cut (from hardened solid blanks) with machine-governed accuracy.

Order through your mill-supply distributor.

NICHOLSON FILE CO. • 97 ACORN STREET • PROVIDENCE 1, RHODE ISLAND
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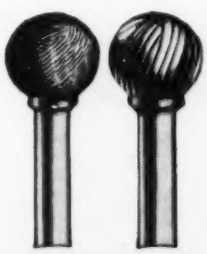
16 STANDARD SHAPES

—in either Hand Cut or Ground. Three cuts—Coarse, Medium, Fine. Stock diameters from ⅛" to 1½".



HAND CUT GROUND

NICHOLSON ROTARY FILES

HAND CUT AND GROUND—FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U.S.A.

MEASURING in MILLIONTHS

. . . for three generations

IN SWEDEN, before the turn of the century, Hjalmar Ellstrom, father of Elmer Ellstrom, the present head of the Dearborn Gage Company, built the first known gage blocks to accuracies of millionths of an inch.

That same Ellstrom was the production genius of the first company ever to sell master gage blocks commercially.

Today, his son and grandsons are carrying on in his footsteps by making gage blocks for industry throughout the world. In fact, they were the only ones to make a major improvement on Hjalmar Ellstrom's original gage block by successfully chromium plating the gaging surfaces of their blocks to increase their wearing qualities.

Yes, in three generations, craftsmanship in millionths of an inch has become a tradition with the Ellstrom family. This has prompted the writing of a booklet entitled, "The Saga of Ellstrom". It tells the complete story of the development of the gage block. Your copy will be sent you upon request, just write the Dearborn Gage Company, 22038 Beech Street, Dearborn, Michigan.

HJALMAR ELLSTROM

ELMER ELLSTROM

OLOF ELLSTROM

Ellstrom

3 GENERATIONS of GAGE MAKERS

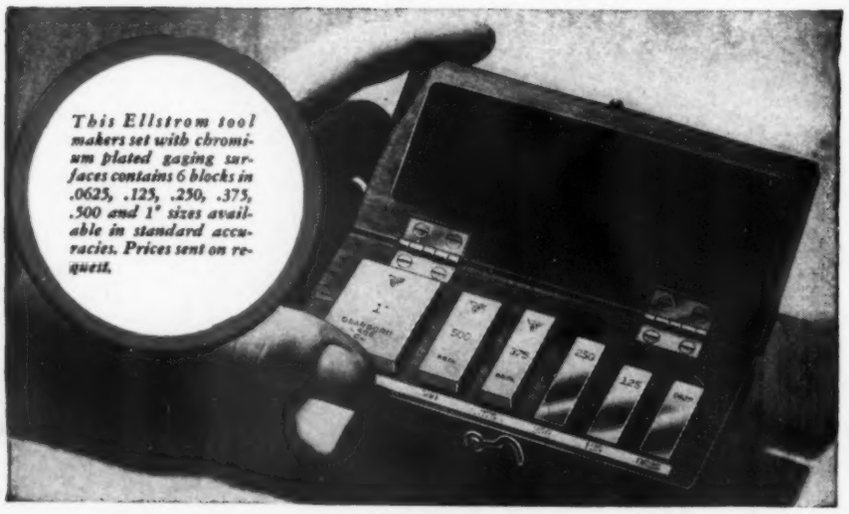
ELMER ELLSTROM II

RALPH ELLSTROM

DEARBORN GAGE CO.

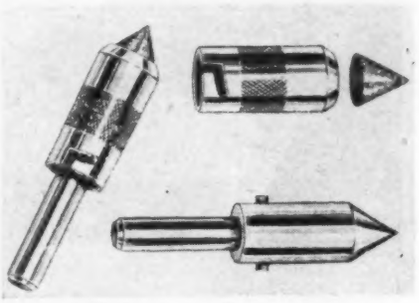
22038 Beech St. Dearborn, Michigan

Originators of Chromium Plated Gage Blocks



This Ellstrom tool makers set with chromium plated gaging surfaces contains 6 blocks in .0625, .125, .250, .375, .500 and 1" sizes available in standard accuracies. Prices sent on request.

Emery-Cloth Cones Replaceable On J. R. Reich Center-Lap Tool

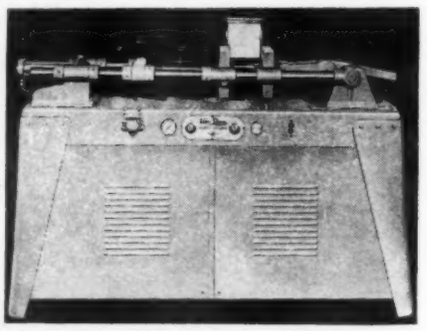


A center-lap tool which has easily replaceable emery-cloth cones fitting over an accurately machined and ground 60° mandrel, is made by the J. R. Reich Mfg. Co., Dept. A, 45 E. Stroop Rd., Dayton, Ohio. The cones are formed with a curved seam which is said to assure accurate lapping without chatter. They are available in 100, 120, and 150 grit. A sleeve holds the cones in place and is fastened with a quick-acting bayonet lock, permitting rapid change of cones. The tool has a 5/16-in. shank.

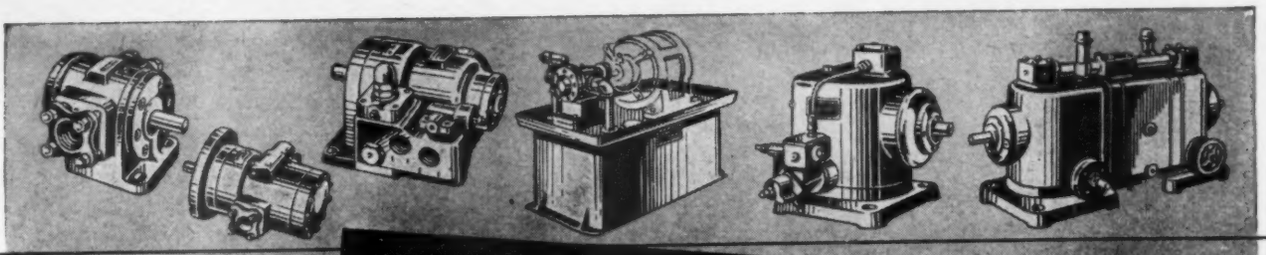
"Liftable" Doubles as Die Table When Not in Use as Shop Lifter

A combination die table and shop lifter which combines advantages of a bench, truck and lifter in a single unit is made by the Service Caster and Truck Div. of Domestic Industries, Inc., Dept. A, 231 S. La Salle St., Chicago, Ill. Called the "Liftable" the unit was designed originally to handle dies in and out of a press but industrial users have found it adaptable for many other purposes. Total lift is 14 in. Height of table top lowered is 28 in., raised 42 in. Size of the table top is 26 x 43 in.

Small Plastic Injection Press Is Powered with 2-hp. Motor



A power-operated plastic injection press of 1 oz. capacity, the H-200, has been developed by Van Dorn Iron Works Co., Dept. A, 2685 E. 79th St., Cleveland 4, Ohio. The press was



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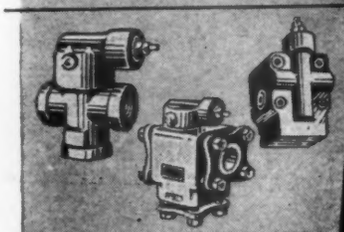
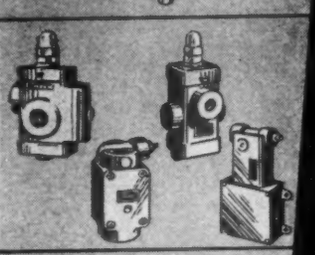
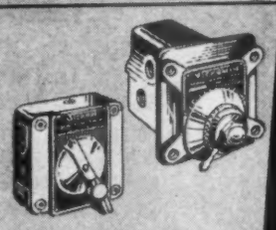
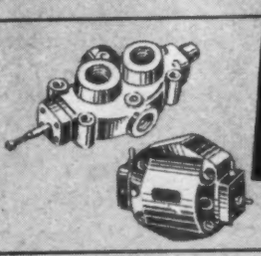
THE MOST COMPLETE LINE
of HYDRAULIC PUMPS and CONTROLS

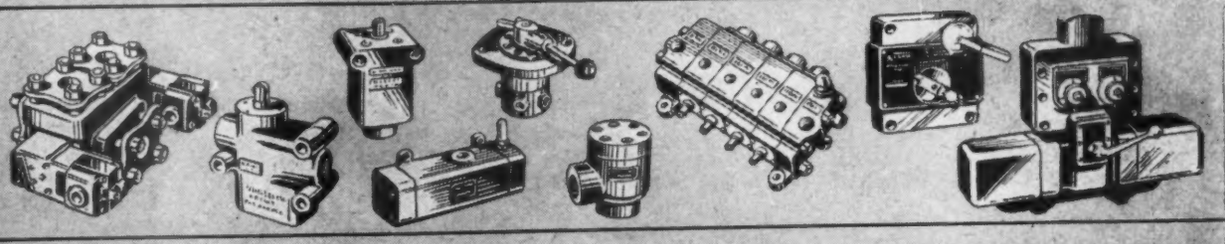
Constant delivery vane type pumps, variable delivery piston type pumps, power units, pressure controls, volume controls, directional controls, cycle control panels, fluid motors, variable speed transmissions . . . these are indicative of the great variety of Vickers hydraulic units. Having the most extensive line of hydraulic equipment, Vickers can meet all hydraulic requirements and provide the important benefits of undivided responsibility. Vickers Application Engineers will be glad to discuss with you how hydraulics can be used to your advantage.

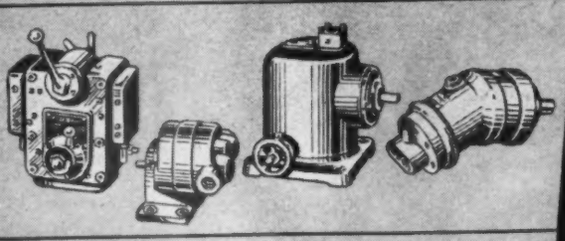












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There are more than 5000 Standardized Vickers Units that can be used in various combinations to exactly supply Every Hydraulic Power and Control Function

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ANY SEQUENCE OF MOTIONS • ANY ACCELERATION
OR DECELERATION • ANY THRUST . . . . . .

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Spiral Gears . . . Spur Gears . . .
Ratchets . . . Helical Gears . . .
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In All Materials:

Brass . . . Steel . . . Monel Metal . . .
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Non-Metallic Compounds
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Perkins' only job is making gears to customers' specifications. You can depend on Perkins for prompt submission of accurate estimates—and for prompt delivery of accurate gears. Your inquiry will receive immediate attention.

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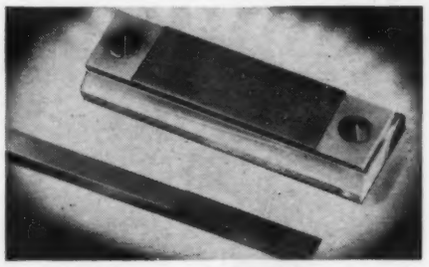
Precision, Custom-Cut GEARS
PERKINS MACHINE & GEAR CO., SPRINGFIELD 2, MASS.

designed to provide a simplified, easily operated molder suited for production, research, and instruction.

Plunger injection and mold closing are operated by hydraulic cylinders. A gear-type pump driven by a 2-hp. electric motor develops up to 1,500-lb. line pressure. Automatic part ejection is accomplished by a simple knock-out and ejector-pin arrangement. Molds may vary in thickness from 3 to 8½ in.

Carbide Tools Dressed Easily With Diamond Files and Hones



A new line of Diamond "R" files and hones for dressing carbide cutting tools without removing them from the machine is announced by the Wendt-Sonis Co., Dept. A, Hannibal, Mo. A 100 concentration of diamonds is contained in a new metal bond which is said to maintain a flat surface throughout the service life of the tool. They can be used on high-speed steels without loosening the diamond particles.

Files measure 6 in. long, ¼ in. wide and 3/16 in. thick, in 240, 320, 400 and 600 grits. The hone measures 3 in. long, ¾ in. wide, and ½ in. thick in 400 grit.

Van Keuren Wire-Type Plug Gages Made of Carboloy for Long Runs

Carboloy wire-type plug gages and thread-measuring wires are announced by the Van Keuren Co., Dept. A, Watertown 72, Mass. The plug gages are made in any size from 0.020 in. diameter to ¼ in. diameter. The gaging units are 1⅞ in. long for diameters up to and including 0.100 in. and 2 in. long for diameters above 0.100 in. They are made with a Class B tolerance of ±0.000025 in., or in coarser or finer tolerances as required. The gaging wire is held in an aluminum handle by means of a split brass bushing and a socket setscrew.

These gages are designed for check-

Turning NICKEL STEEL AT 230 S.F.P.M.

SUNOCO EMULSIFYING CUTTING OIL

"Job-Proved" under Severe Operating Conditions, Maintains Accurate Cutting Edges on Tools

When heavy cuts and heavy feeds are taken on nickel steel . . . and peak production is to be obtained . . . it is essential to maintain accurate cutting edges with long intervals between grinds.

Here is a case where a manufacturer's preference for Sunoco Emulsifying Cutting Oil is based on that type of performance.

Operation: rough-turning forged spindle
Machine: Monarch Model "M" 20" engine lathe
Surface cutting-speed: 230 feet per minute
Material: S.A.E. 2350
Depth of cut: 3/8"
Feed per revolution: .015"
Type of tool: tantalum carbide
Cutting lubricant: 1 part Sunoco to 10 parts water

Sunoco is "Job-Proved". It has won the approval of leading machine-tool builders and metal-working plants for its outstanding work in a wide variety of tough metal-cutting operations.

Outstanding lubricating, heat-absorbing, and rust-preventive qualities of Sunoco make possible longer runs between regrinds, greater accuracy, better finish, fewer rejects, and worthwhile savings in production time. A test in your own plant will convince you.

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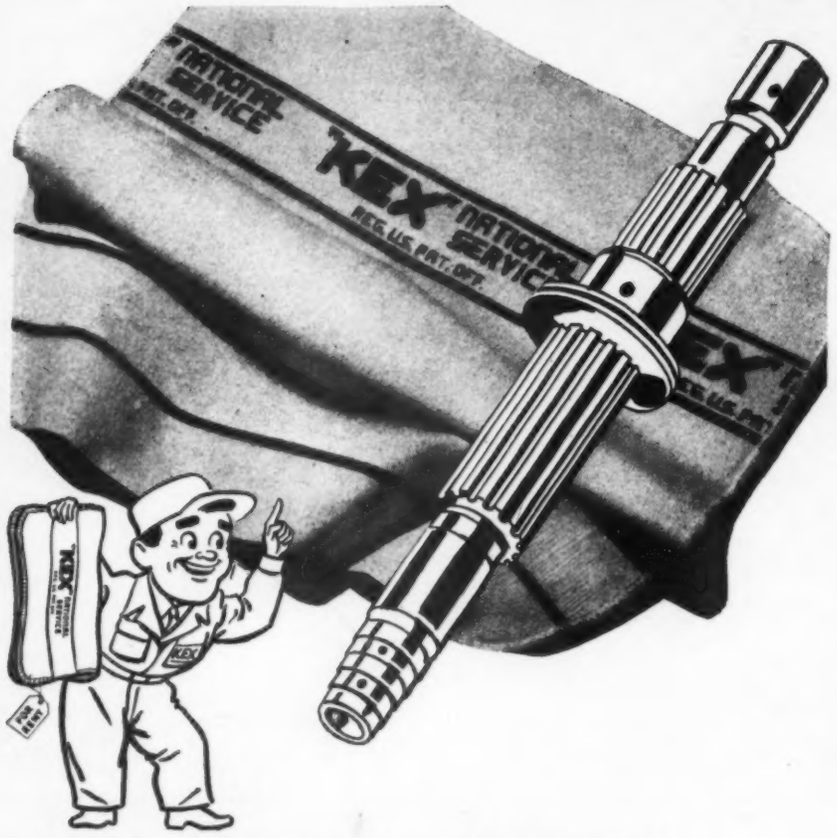
INDUSTRIAL PRODUCTS



LOOKING FOR A WIPER THAT'S EASY ON POLISHED STEEL? ...then try "KEX" WIPING CLOTHS

KEX Wiping Cloths are soft and safe. They have no abrasive dirt—no buttons, hard seams, etc.—to dig into delicate finishes. And every square inch of a KEX Wiping Cloth is *wiping* surface—hundreds of more wipes per pound over ordinary waste or rags.

KEX Wiping Cloths are uniform in size—distribution is easier to control. And fresh KEX Wiping Cloths—chemically cleansed by a *special* high-heat process—are delivered as often as needed. You always have plenty of clean KEX Wiping Cloths on hand.

Rent KEX Wiping Cloths and Figure Your Profits

Try the KEX Wiping Cloth system, today! There's nothing to buy, no expensive inventory—just a low monthly rental. And the very first month should show a considerable saving on wiping costs. For complete information, phone your local KEX representative—
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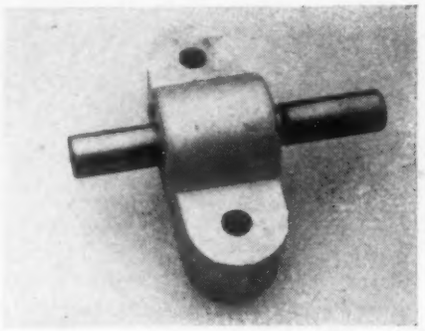
"KEX" REG. U. S. PAT. OFF. NATIONAL SERVICE A CALLAWAY MILLS PRODUCT INDUSTRIAL WIPING CLOTHS

ing small holes where production runs are long or the material is extremely abrasive. A life of 50 times that of tool steel is realized with carboloy gaging units. However, owing to the presence of numerous small pits and voids in the sintered tungsten-carbide material they are not recommended for use where an accuracy to the exact 0.0001 in. is necessary.

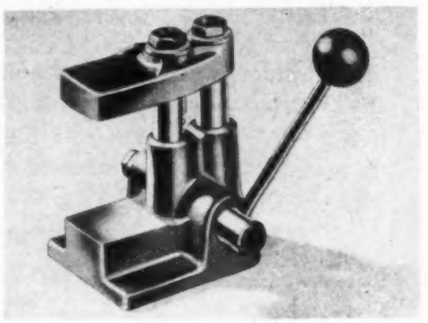


ARBOR—A plain Spindle arbor, Model B15-0, is made by Poly Pruducts, Dept. A, 406 S. Chester Ave., Pasadena 5, Calif. Permanently lubricated and sealed ball bearings are mounted in a cast aluminum housing. The spindle is 5/8 in. in diameter and has working ends of 1/4 and 1 1/2 in.

P&H Electrode for Easy Use In Out-of-Position Welding

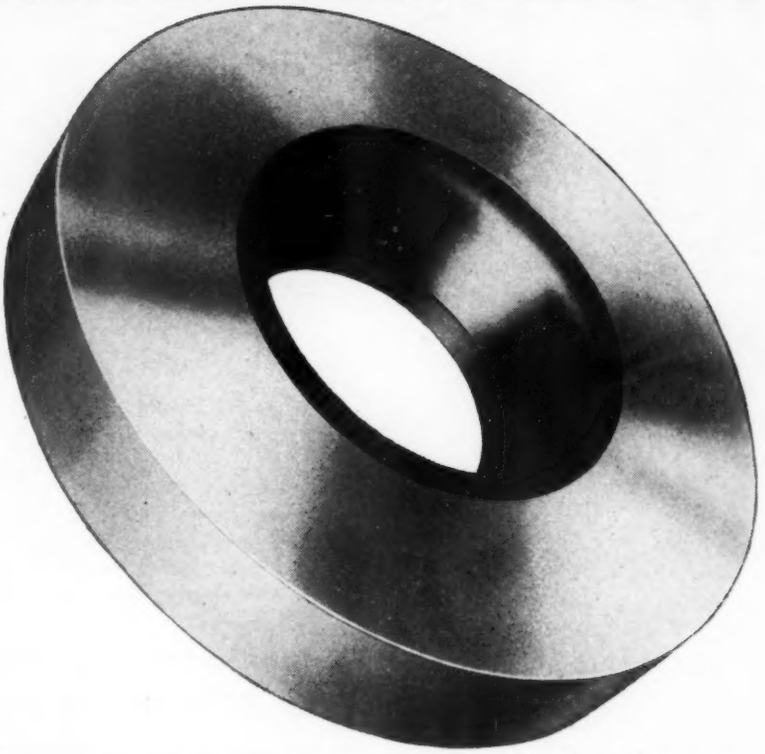
An electrode developed for operating ease in out-of-position welds is AP, announced by Harnischfeger Corp., Dept. A, 4400 W. National Ave., Milwaukee 14, Wis. The electrode has a spray-type arc with deep penetration qualities. It is said to give unusually low spatter loss and has exceptionally thin slag. Because of its versatility, the 3/16 in. size can be used in place of 5/32 in. in all positions.

Two "Miniature" Clamping Jigs Use Cone-Lok Operating Method



Two standard clamping jigs for small parts have been introduced by N. A. Woodworth Co., Dept. A, 1300 E. Nine Mile Rd., Detroit 20, Mich. The Miniature" Cone-Lok jigs have the

Get these 7 Benefits
OF CARBOLOY SHEET METAL DIE USE



- Long Die Life ❶
- Closer Limits ❷
- More Continuous Operation ❸
- Fewer Rejects ❹
- Lower Cost ❺
- Better Finish ❻
- Increased Production ❼

Steadily growing in the importance and range of applications, producing a wide variety of sizes and shapes of parts, carbide sheet metal dies are constantly establishing amazing records for low cost, high quality performance.

Seven Important Benefits Now Obtained

Well known users consistently report these seven important benefits resulting from Carboloy Die use: Unusually long die life, closer tolerances on drawn parts, more continuous press operation, fewer "rejects", lower cost per piece, vastly improved surface finish—almost "mirror-like" in quality (often this means less buffing time)—and a substantial increase in output per press.

CEMENTED CARBIDES

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SHEET METAL DRAWING DIES

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For your convenience, the coupon may be used to obtain specific information with regard to the benefits of Carboloy Die use on your sheet metal drawing application.

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Efficiency and long life of Norgren Regulators is due to floating diaphragm and syphon tube. **FLOATING DIAPHRAGM:** a resilient member of great strength, assures flexibility, quick action and long life. **SYPHON TUBE:** action of the air as it passes over this tube opens valve wider, permitting a *larger volume* of air to pass with *less pressure drop* than conventional regulators.

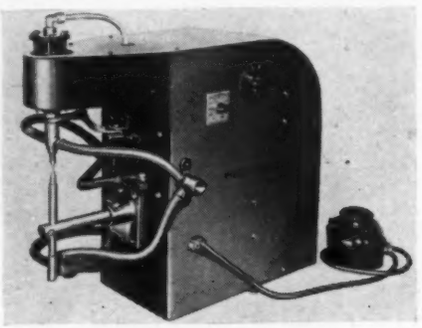
Get the facts today. Learn how simple design and precision construction of Norgren Regulators step up performance and cut pneumatic power costs.

Write for catalog No. 400. C. A. Norgren Co., 220 Santa Fe Drive, Denver 9, Colorado.

Norgren

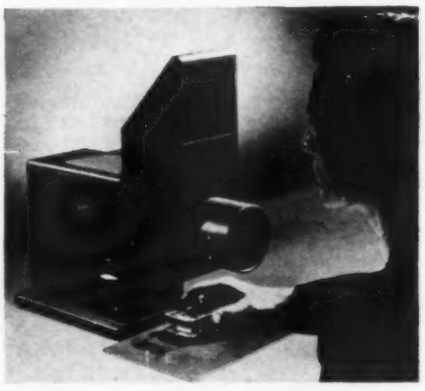
same operating principle as the larger sizes.

The new jigs have working spaces of 1 x 1 x 1 in., and 1 x 2 x 1 in. They may be assembled or dismantled in a very few minutes and can be quickly converted from right- to left-hand operations. Moving parts operate in an oil bath. No movement of working parts is possible without action of the operating lever.



SPOT WELDER—An improved bench-type spot welder Model 263-A, is announced by Weldex Inc., Dept. A, 7324 McDonald Ave., Detroit 10, Mich. It is a 3-kva., 220-v. 60-cycle, single-phase precision welder for lightweight metal. It is foot controlled and electronically timed with an adjustable pressure switch

Distortion Is Not Encountered In Optron Interference Viewer

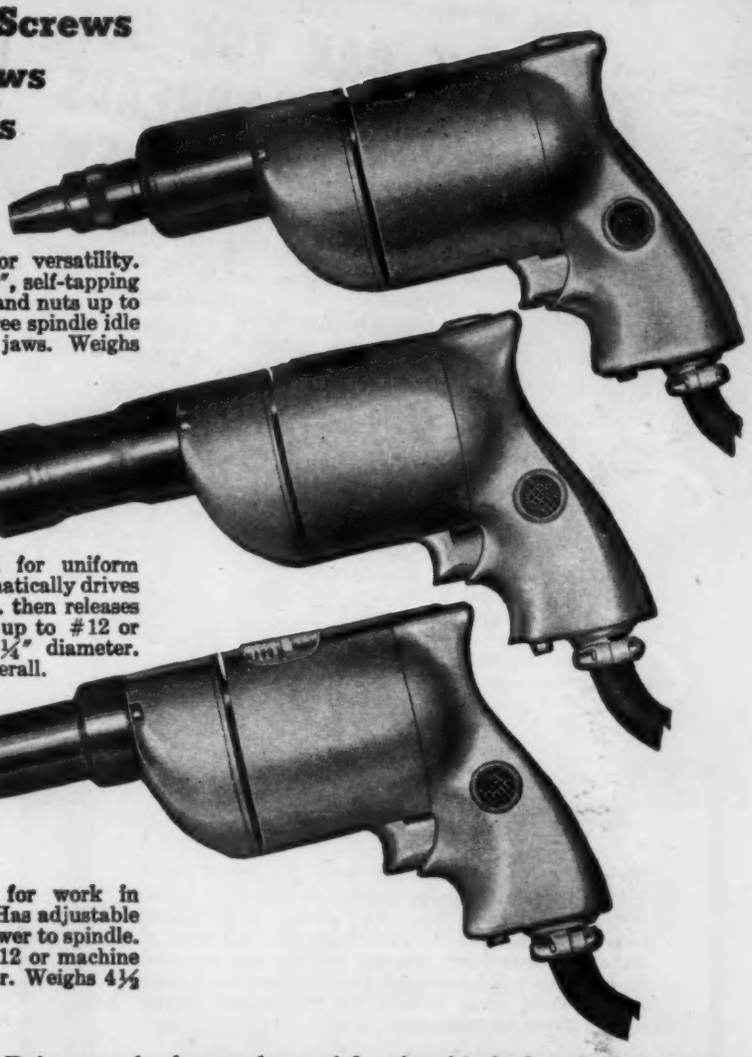


Uniformly accurate measurements of gage blocks, anvils, sealing surfaces, and other precision articles is said to be possible with the Interference Viewer announced by Optron Laboratory, Dept. A, 2651-B, Salem Ave., Box 25, Dayton 6, Ohio. Interference patterns are both illuminated and viewed on a line perpendicular to the plane of the pattern. Distortion is completely eliminated. Each pattern appears the same to different observers, simplifying inspection of one pattern by several observers and removing one of the chief problems of optical measurements.

The monochromatic light source is

You Name it - They Drive it

- **Self-Tapping Screws**
- **Machine Screws**
- **Nuts and Bolts**
- **Wood Screws**



Positive Clutch Scrugun—Designed for versatility. Drives wood screws up to #10 x 2", self-tapping screws up to #12, machine screws and nuts up to ¼" diameter. Positive clutch lets free spindle idle until operating pressure engages jaws. Weighs 8½ lbs. Measures 8¾" overall.

Adjustable Clutch Scrugun—Designed for uniform production. Adjustable clutch automatically drives every screw to uniform tension . . . then releases spindle. Drives self-tapping screws up to #12 or machine screws and nuts up to ¼" diameter. Weighs 8¾ lbs. Measures 10¼" overall.

90° Angle Drive Scrugun—Designed for work in close quarters and around corners. Has adjustable clutch. Angle head transmits full power to spindle. Drives self-tapping screws up to #12 or machine screws and nuts up to ¼" diameter. Weighs 4½ lbs. Measures 10¾" overall.

Black & Decker Electric Screw Drivers and Nut Runners speed up practically every type of assembly work . . . from the most delicate screw driving operations to driving and tightening nuts and bolts up to 1" diameter or lag screws up to ¾" x 6".

Light, compact, easy to handle . . . powerful and dependable . . . these Black & Decker Power Drivers assure top-speed production with greater accuracy and uniformity . . . with a minimum of operator strain and fatigue. Right now, exceptionally heavy demand for that kind of performance keeps the supply of these tools scarce . . . but it makes sense to wait a little longer for tools that have so much to offer.

Three of these time-saving, cost-cutting assembly tools are shown on this page. For full information about all models, see your nearby Black & Decker distributor. For your free copy of our 60-page illustrated "Power Assembly Tool Data Book," write to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC **TOOLS**

TAPPING TIPS

From Woody Spencer's Notebook

BOY, CAN YOU GET COCKEYED THREADS WITH A SET SCREW

Best way I've seen for getting oversize cuts and cockeyed threads is to use a set screw to lock the tap shank to the spindle. Even a little extra pressure on the screw is almost sure to cock the tap a little out of line. You know the result; bell mouth, oversize holes, rough, torn threads. Usually winds up too, with a broken tap. There's nothing like a tight, rigid holder and a little foresight in seeing that holder, tap and hole all line up true. Pays off too, in faster, easier work and fewer rejects.

We don't want you to take these Tapping Tips of Woody's as engineering advice designed to solve tapping problems. They are merely handy hints, bits of information and short cuts that the boys in some shop have found out and they are being passed on by Woody for whatever they're worth in saving time, making some routine job run easier, maybe cutting down on rejections.

For the individual problems that come up so frequently, we suggest definite engineering advice. Send us complete data on the job—kind of material, diameter and depth of hole, whether it is blind or through, what kind of lubricant used and any other information regarding the job. Our engineers will be glad to make recommendations covering the job without obligations, of course.

You'll find a copy of Woody Spencer's Handy Tap Guide a mighty useful mine of tap information, all arranged and indexed for quick, easy use. It's FREE. Write for your copy on your company letterhead.

NOTE: Woody Spencer's Tapping Tips will appear here as often as Woody gets time to write them up. Look for them.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company

Cleveland 3, Ohio

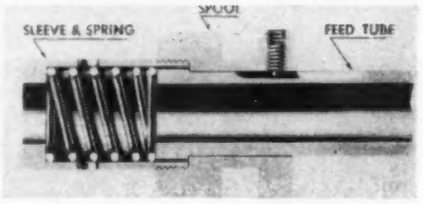
completely concealed. The image of a scale can be superimposed on the interference pattern itself, permitting convenient comparisons of straightness or direct measurements between interference bands. Haidinger bands can be used in tests for parallelism without accessories of any kind.

Metzgar Portable Conveyor Unit Has No Idler Rollers on Return

A portable conveyor unit, the "Power Helper" is made by the Metzgar Co., Dept. A, Grand Rapids, Mich. This unit has a power-driven belt with speed variable from 40 to 50 ft. per min.

It is adjustable from a horizontal position, where it is 18 in. high, to a 45° pitch. The basic machine has an operating length of 6 ft., but can be increased in multiples of 1 ft. up to 10 ft. Belt tensioning is automatic and return idler rollers are not used.

Shock-Absorbing Feed Tubes Made for B. & S. Automatics



A complete line of shock-absorbing feed tubes for all sizes and models of Brown & Sharpe automatics which do not have a spring safety device incorporated in the feeding mechanism of the machine, is announced by Modern Collet and Machine Co., Dept. A, 401 Salliotte St., Ecorse 18, Mich. Forward movement of the screw-machine feed latch is transmitted from the spool to the tube though a sleeve and helical compression spring. Normal feed does not

2500 PER HOUR

Valve stem ends TOCCO-hardened to depth of 3/32". Hardness of 50 Rockwell "C" accurately controlled.

300 AXLE SHAFT BEARING RACES PER HOUR. Hardens axle bearing to 62 Rockwell "C". Eliminates inner race formerly pressed on. Gives 50% more strength.

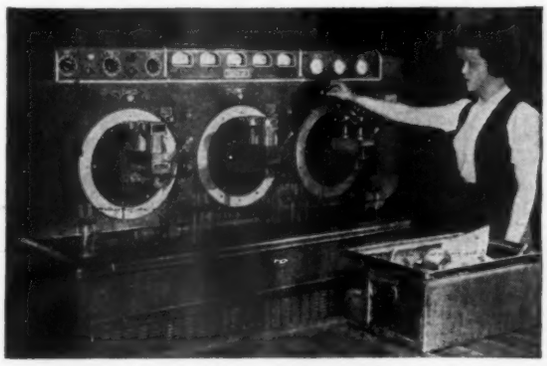
2000 PISTON PINS PER HOUR. Continuous hardening of carburized piston pins to 62 Rockwell "C". Pins TOCCO-hardened free of distortion and scale.

500 DISTRIBUTOR CAMS PER HOUR. Cam surfaces TOCCO-hardened to 62 Rockwell "C" after assembly eliminating copper plating.

100 ROCKER SHAFTS PER HOUR. TOCCO-hardened at six areas per shaft. TOCCO fixture accommodates shafts 14" to 36" in length, having 6 to 12 hardened areas. No scale or distortion.

FOR TODAY'S TEMPO:

Get this SPEED and VERSATILITY with a Standard TOCCO Unit



Speedy, accurate TOCCO Induction Hardening enables you to produce better products, faster, *at a fraction of the cost* of conventional heat-treating. One manufacturer gets such results for 142 different parts . . . with one standard TOCCO machine! Fixtures are readily changed, permitting quick tool-up to suit the job.

Find out how TOCCO's speed and versatility can help solve *your* problems and save *you* money. "Results with TOCCO" free for the asking.

THE OHIO CRANKSHAFT COMPANY • Cleveland 1, Ohio

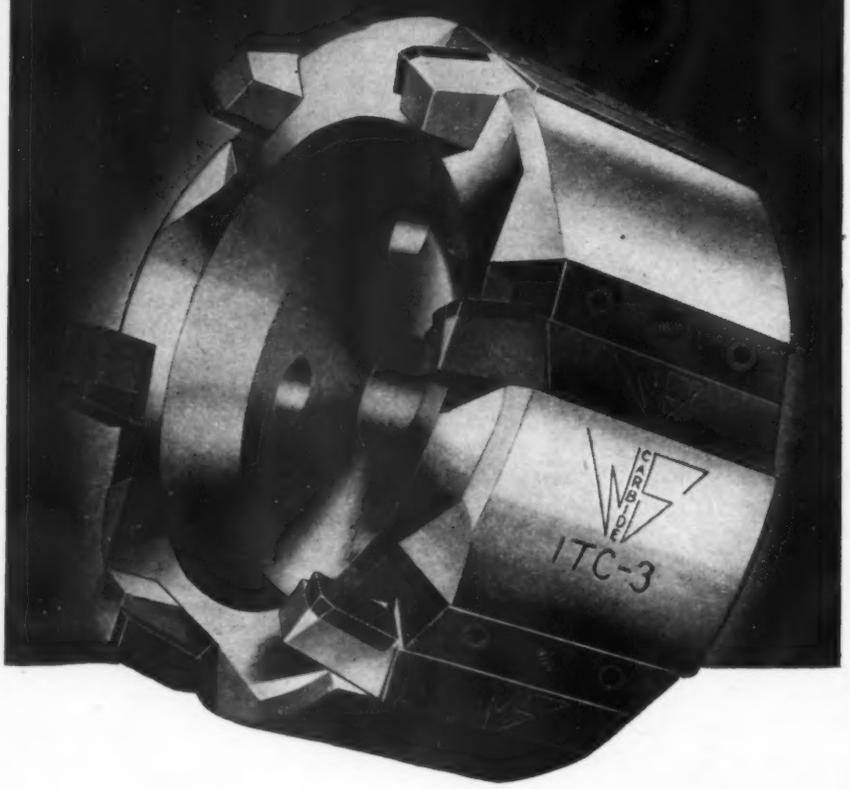
TOCCO

INDUCTION

HARDENING, BRAZING

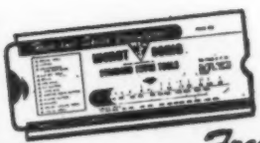
ANNEALING, HEATING

WENDT-SONIS CARBIDE TIPPED Inserted Tooth Cutter



Requires up to 30% LESS POWER than ordinary cutters

- **USE ON PRESENT MACHINES.** W-S Inserted Tooth Cutters are designed for high efficiency on your present machines.
- **MILL ALL TYPES MATERIAL** with only the one cutter body. Simply change blades. New principle permits faster blade changes.
- **MAINTENANCE COSTS ARE LOW** because blades are easily sharpened and inserted. Long service life.
- **REFER TO "TOOLS"** in your Classified Directory for local W-S Distributor or write Wendt-Sonis Company, Hannibal, Missouri. Pacific Division: 580 North Prairie Ave., Hawthorne, California



Free! **W-S SPEED and FEED CALCULATOR for Carbide Cutters**—Gives correct feed per tooth per r.p.m. Also gives basic rough and finish cuts for all materials. Write on business letterhead for your FREE Wendt-Sonis Calculator.

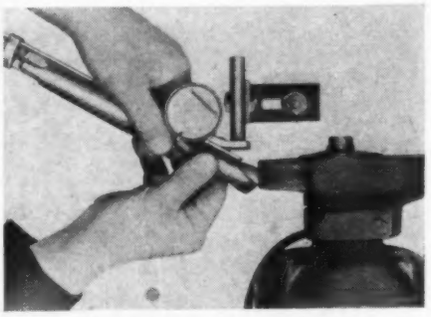
W-S FACTORY TRAINING COURSE, *FREE!* One week's intensive training, at our factory, in application, use and maintenance of carbide cutting tools. Small classes, individual instruction. Practical facts, actual shop practice. Write for details.

WENDT SONIS
CARBIDE TIPPED CUTTING TOOLS
BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL TOOLS

deflect the spring, but if interference occurs the spring compresses, and the spool slides forward freely on the tube. This prevents breakage of the feeding mechanism or damage to the tube. The same action will occur if there is interference with full advance of the stock itself.

Short Drills for Screw Machines Are in New Chicago-Latrobe Line

For use in screw machines where operating conditions require short, sturdy drills, a line of stub screw-machine drills is made by Chicago-Latrobe Twist Drill Works, Dept. A, 411 W. Ontario St., Chicago 10, Ill. Customary practice has been to use regular drills, cutting off a portion of the flute, spinning the web, and repointing. The new stub drills are available in wire gage from No. 1 to No. 60, letter sizes A to Z, and fractional sizes from 1/16 to 2 in. They are made with short flutes and with the proper heat-treatment to assure maximum tool life between grinds.



DRILL SHARPENER—Turning the calibrated dial sets this sharpener so that both cutting edges and both angles of drill will be ground exactly alike. Takes drills from 5/32 to 1 in., with either straight or No. 2 taper shank. Made by Majestic Drill Sharpener, Dept. A, 1100 Second Ave., S. Minneapolis 2, Minn.

Pneumatic Grinder Like Feather; "Junior's" Weight Mere 12 Ounces

A small, lightweight "Junior" pneumatic grinder, weighing only 12 oz., and operating at speeds to 75,000 rpm., is the Model M-C.R., built by M-B Products, Dept. A, 130-134 E. Larned St., Detroit 26, Mich. A simple valve for control of air will remain in any set position to control grinder speed.

The tool has a steel body and a spindle made of alloy steel for toughness which is heat-treated and ground to close limits. Grinding wheels, rotary files, and cutters with ⅛-in. diameter shank are used.

ROUND TABLE DISCUSSION

HOW ABOUT AN ANNUAL WAGE

Al's suggestion of an annual wage deserves a lot of careful thought by both management and labor. Judging by the comment of A. Eyles, of England, there is a lack of understanding of what it really is.

No one denies that the best stimulus toward increased efficiency is to pay according to results, as he says. But there is no reason why this precludes the use of the annual wage. In fact it is understood that in the plants where the annual wage is already established, the use of incentives has increased worker efficiency. It is clear that the higher the efficiency of a plant the greater the annual wage could be.

No one expects an annual wage to equal the highest earnings of the men. The annual wage proposed is merely a base wage, paid throughout the year, to be supplemented by payments in excess of the base, which may be earned. The annual wage would cover moderate living expenses without the necessity of running into debt to the landlord, the butcher or the grocer, during slack times.

The use of incentives seems to be just as practical in connection with the annual wage as without it. Nor can I see why it would increase commodity prices in metalworking plants more than in meat packing or shoe making, where it is already in use. Many feel that the plan has sound possibilities and is especially desirable in seasonal industries, such as the building trades. It requires a careful study of conditions and sound understanding by both management and labor. Many feel that it should help to prevent the costly struggles of labor which now delay production and increase costs.

F. H. Carstairs
New York City

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SHOULD MACHINISTS BE LICENSED?

I have read your magazine from cover to cover for many years. The Round Table discussions on licensing machinists have been most interesting and prompt me to say a few words on the subject. I might first explain that I've had nearly 57 years of the machinists' trade, serving a four-year apprenticeship in a large contract shop and doing most of my early work at my father's side.

Ryerson – Quick Source for

INLAND 4-WAY FLOOR PLATE

Take a careful look at this close-up of Inland 4-Way Floor Plate. Note the 4-way projections. Now read of the advantages Inland 4-Way Floor Plate provides:

1. *Safer traction.* Wherever sure footing is important, on walkways, stairways, around machinery, on floor and steps of trucks and other moving equipment, the projections of Inland 4-Way Floor Plate grip feet or wheels from every angle. Give 4-way protection against dangerous falls.

2. *Longer wear.* Inland floor plate is rolled from tough, open hearth steel with high wear resisting qualities.

3. *Great structural strength.* The overlapping projections reinforce lengthwise and crosswise giving Inland 4-Way Floor Plate greater stiffness.

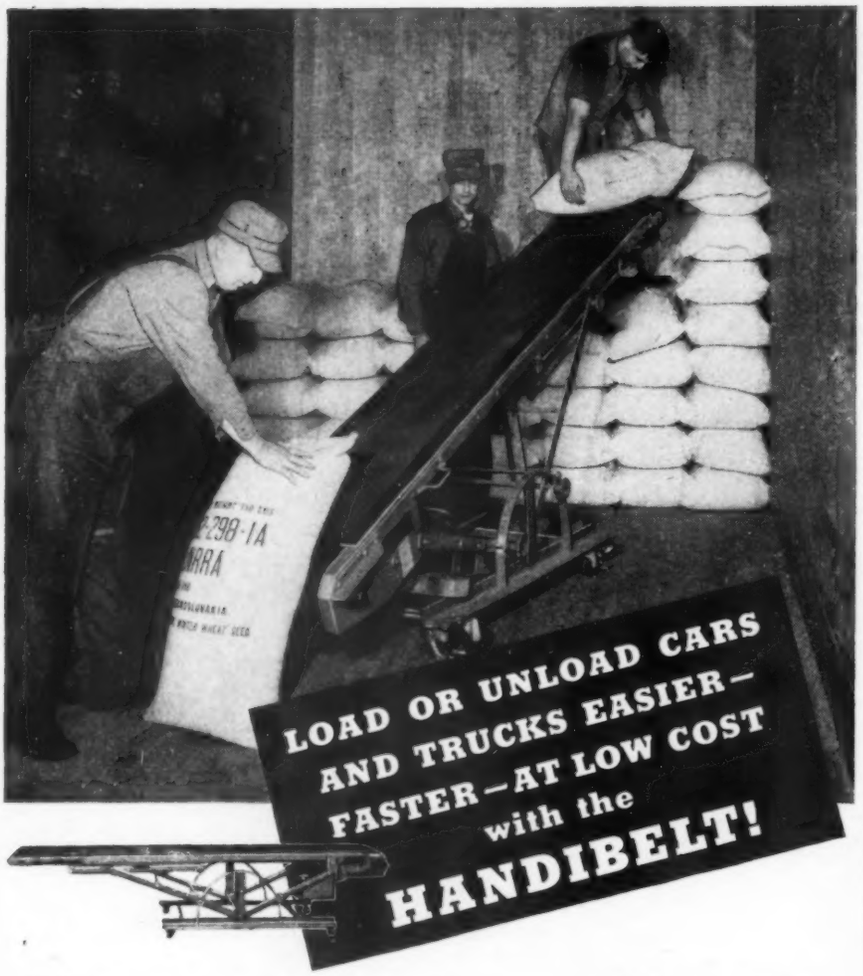
Then you get the additional advantage of a continuous pattern that is pleasing in appearance; matches whether laid side to side or end to end and permits sweeping and drainage in four directions.

Inland 4-Way Floor Plate is available for quick delivery from Ryerson Steel-Service Plants, in two pattern sizes and several thicknesses. Write for catalog and samples too if you care for them.

Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: Chicago, Milwaukee, Cleveland, Cincinnati, St. Louis, Detroit, Philadelphia, Pittsburgh, Buffalo, Boston, New York.

Other Products: Carbon and Alloy Steel, Allegheny Stainless. Bars, Plates, Sheets, Structurals, Tubing, Reinforcing Bars, Bolts, Rivets, Metal Working Machinery and Tools, etc.

RYERSON



Hard-to-get-at spaces are easily reached with the Handibelt—the all purpose incline, decline or horizontal portable belt conveyor. Its design allows the carrier belt to be horizontal at any height from 18 inches to 42 inches. It can be used as a piler elevating from 10 inches to 6 feet 3 inches or from 30 inches to 7 feet 6 inches, or any angle or degree between those extremes. Either end may be raised or lowered.

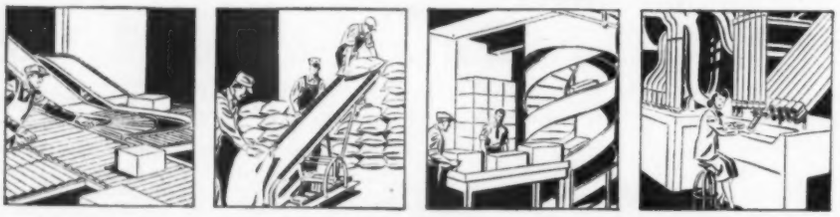
The Handibelt handles boxes, cartons, crates, bags, and other packages up to 100 lbs. The rubber covered belt is free of side rails — commodities wider than 14 inches may be carried.

This flexible unit may be used as a piler, a horizontal conveyor, a connecting link between other conveyors, as a feeder conveyor. Any number of Handibelts can be placed in line to form a continuous conveyor to reach remote spaces.

Weighs less than 500 lbs. — easily wheeled about by one person. Equipped with ⅓ hp. motor—plug it into any ordinary lighting circuit.

Get complete information today — write for Handibelt Bulletin No. AM-56

STANDARD CONVEYOR CO.
General Offices: North St. Paul 9, Minn.
Sales and Service in Principal Cities



ROLLER · BELT · SLAT · PUSHBAR CONVEYORS · PORTABLE CONVEYORS AND PILERS · SPIRAL CHUTES · PNEUMATIC TUBE SYSTEMS

The country today is flooded with young men who, after serving two or three years in a war plant, call themselves tool or die makers rather than just plain machinists. After a brief conversation with some of these fellows, I'm convinced they can't fill the bill in normal operations.

I carried a machinist's card for many years. When I joined the union it was necessary for an applicant to prove by four union members that he had served an apprenticeship and was efficient in the line of work for which he applied. No one should have a union card unless he is a journeyman.

MICHAEL HANNA

There is a feeling against apprentices in many shops. Some old heads laugh at a boy if he breaks a drill or tap, or ruins a job. I don't approve of such an attitude. Many times during my years in different shops I have stopped my machine when I saw an apprentice on the wrong track. I took a special delight in showing the lads what I knew and they would all come to me for advice when they stalled. I still hear from those fellows today and it gives me a great feeling of satisfaction. I don't see how a lad can learn a trade if he has no one to go to when he's in deep water.

Another reason why the all-around machinists are disappearing can be placed at the steps of many manual training schools connected with most high schools. I know of two instructors who don't know how to handle a tool or make a setup any better than the pupils because they never had a day of practical experience. It seems

to me that qualifications for machine-shop instructors should include a measure of practical experience because this is one of the best teachers.

Michael Hanna
Earlington, Ky.

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HOW ABOUT SCHEDULED MAINTENANCE?

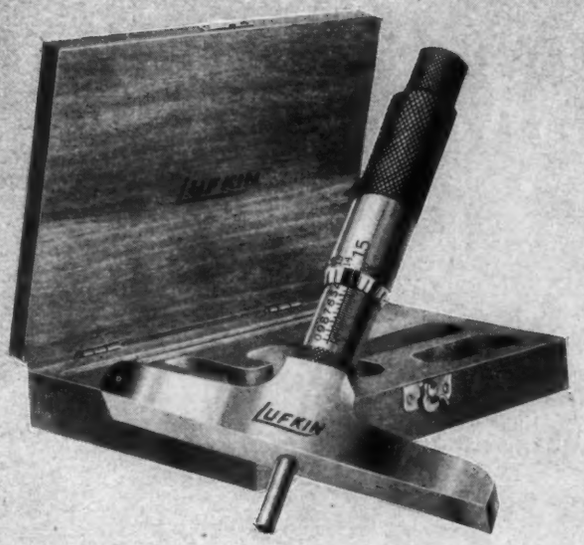
To keep the shop running regularly and to avoid delay as a result of unforeseen troubles with the shop machinery, I am convinced that best results are obtained by giving the maintenance to a special department. The best way is to make a difference between machinery and tools. Both have to be handled for maintenance by specialists. My experience has been that in a shop with an extended number of machines, two departments for maintenance—one for machinery and one for tools—will give the best results.

However, what happens in the case of Robin Hood versus Al in my opinion is altogether wrong. The maintenance department has to be familiar with all the machinery and its condition. On this knowledge a schedule of maintenance is made and the shop boss will receive a copy of such a schedule so he may see a month beforehand of which lathe or planer he will be deprived. This schedule ought to be made up by the maintenance department by mutual agreement of the shop boss and the planning office. It would not do in the case of a large order where certain machinery is wanted, that along comes Robin Hood to tell the people that tomorrow he will snatch the planer away. Certainly this is a wrong way of organization.

After each overhaul, the lathe, or whatever machinery it is, will be tested for precision. This must be done on a fixed routine and the results noted down in forms, which are kept with the machine. As a result of this check, the shop boss accepts the overhauled lathe, or in case he is not satisfied, refuses it and sends it back to Robin Hood. This acceptance test may be regarded as an end-inspection. Once I came across a case, where a capstan lathe had just been overhauled. The precision test told me there was something wrong and on investigation I found a faulty fitted key in the turret. Had we not made the test, the lathe might have been put in service and it might have taken a long time before the fault would have been recognized. Meanwhile the lathe would not have given the precision of which it was capable.

Another result of the acceptance

LUFKIN MICROMETER DEPTH GAGE



ACCURATE

EASY TO USE

For easy, accurate depth measuring of finished holes, keyways, and slots, toolmakers prefer Lufkin Micrometer Depth Gages. Hardened and ground base, 3" or 5" long, sits firmly without rocking. Interchangeable rods for 0 to 3" measuring have hardened and lapped ends, and are equipped with adjusting nut to compensate for wear. Knurled surface at top of both sides of head assures firm grip. Exclusive!—only Lufkin Micrometer Depth Gages have patented lock nut that maintains reading. For free catalog write THE LUFKIN RULE CO., SAGINAW, MICH., New York City.

BUY THROUGH YOUR DISTRIBUTOR

LUFKIN FOR ACCURACY

No. 1993 "Yankee" Vise

"YANKEE"
VISE
WITH SWIVEL BASE
FOR BENCH AND MACHINE

Removed from its swivel base, a "Yankee" Vise can be used in practically any position. Suppose you have a job in the vise and you want to transfer that work to the drill press or milling machine. Simply detach the vise from its base, do the other operations, bring the vise back to the bench, put it back on its swivel. You have maintained correct alignment from start to finish without disturbing the work. You have avoided time-consuming set-ups for each operation.

"Yankee" Vises with swivel bases are made in four sizes, with a jaw opening from 1½" to 4". Each comes equipped with a grooved V-block for holding round or irregular work. The time- and labor-saving feature of these vises is typical of *all* "Yankee" tools—screw drivers, braces, and drills. Order from your industrial supply distributor, or write direct to Dept. A-M 646.

NORTH BROS. MFG. CO.
Phila. 33, U. S. A.
Established 1880
Division of The Stanley Works
Send for the "Yankee" Tool Book

"YANKEE"
TOOLS

test is to divide the lathes in three groups according to precision. These groups are known to the planning office, and the men who are preparing the work for the shop note on which lathe a certain order has to be carried out.

On every lathe, planer or shaper, the date of the last overhaul is painted. I introduced a system by which an overhauled lathe was painted in a slightly different color, so that on entering the shop one could see at once the newly overhauled lathes.

G. Spit
de Bilt, Holland

•

SHOULD A FOREMAN BE COST CONSCIOUS?

To make a foreman cost conscious seems to be a logical and practical step to take, but it is unfortunate that the first move to make is to add yet another training course on the foreman's list. The logical conclusion appears to be that you cannot go halfway with such a project. Success or failure will depend largely on the type of management.

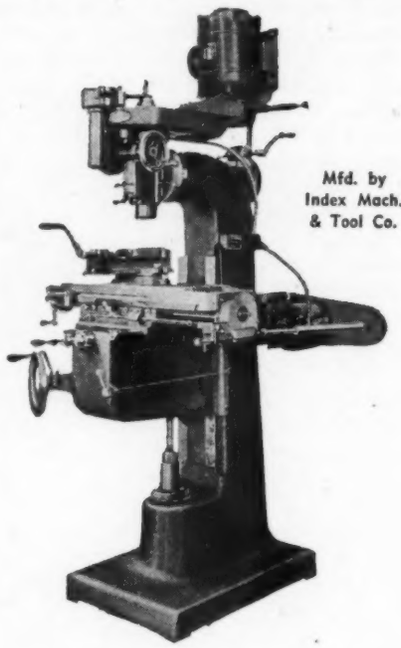
If a foreman is to be cost conscious, he must be informed of costs, not just times. If he knows costs, he will in most instances know selling prices because that is the very next thing that human nature will incite. Furthermore, it takes a lot of figures and explaining to some employees to convince them that if all products had a selling price based on 25% above the cost, it never works out anywhere near a 25% profit over the year. If a management is prepared to be contented with a limited profit percentage, it could well afford to reveal its accounts to such an extent as to make it practically feasible to make not only the foreman but all the employees cost conscious. The results would be certain to be alarming. The company could eventually afford to pay higher wages and salaries all-around, if necessary.

It is well known what an immense saving in cost the simple piecework system brings where the job is simple enough to be so run, and there is little doubt that a 100% cost-conscious company would almost certainly show a considerable saving in costs and therefore an increase in profits. The major portion of any increase in profits should be paid out to the employees with a nominal extra 10% or 15% for the directors or shareholders.

It would be possible for an unscrupulous management to bring down selling prices as a result of decreased costs, thus robbing the employees of dividends, but with the underlying motive of increasing turnover. In

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table

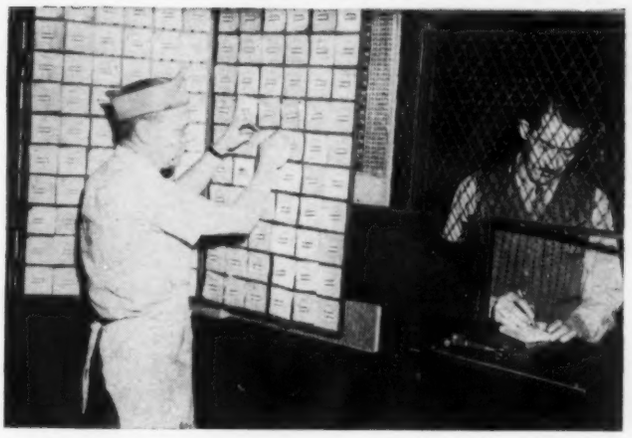
A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY
3100 E. MICHIGAN AVE.
JACKSON, MICH.

CROCKER-WHEELER benefits 6 Ways with McCASKEY TOOL CONTROL

Tangible savings in tool costs and production time and how they were effected are outlined in the following abstracts from "Guard Your Tools", by Milton L. Borden, Tool Supt., Crocker-Wheeler Electric Mfg. Co. in the April 25, 1946 issue of American Machinist. They may suggest similar savings in your plant.



1—*$3000 in Tools Recovered:*

Our first step was to scrap obsolete and unusable tools. A complete inventory of remaining items was taken and a notice issued requiring employees to return brass checks and tools. Results were astounding. We had returned better than $3000 in small tools that we neither knew had been issued, nor where they were.

2—*Faster Service—More Production:*

Many workers, especially if piece workers, at first object to signing tool loan slips, claiming it takes too much time. We have refuted this many times by making time studies over a 10 or 24 hour period of the transactions at a given tool crib. We have found 500 to 700 transactions during a study, each taking an average of 30 seconds.
Under the old brass-check system, we have determined that individual transactions take an average of 1.4 to 2.2 minutes, most of this time having been spent in searching for the brass check, searching for the tool and arguments between crib men and operators. Less non-productive time at tool cribs means more production at the machine.

3—*Reduced Tool Stocks and Purchases:*

Three different times we have reduced our tool stocks until now we are operating with a 40% reduction in the total number of tools, but with more and better tools of the right kind. We have reduced tool purchases by approximately 60%.

4—*Breakage Reduced 40%:*

A monthly record of breakage is sent to management for further steps considered necessary, whether the fault lies with operator, method or operating condition. A report for each operator shows whether he is costing us more in broken tools than he is worth in production.

5—*Tool Cribs and Attendants Reduced:*

Since the system was installed, we have been able to reduce the number of tool cribs necessary to serve our plant from seven to five and number of crib attendants from eleven to six. We maintain far more production with less tools by enforcing the return of tools when jobs are finished. A monthly check-up is made of tools out on tool order slips, and those not in actual use must be returned. Hoarding is practically eliminated.

6—*Lost Time at a Minimum:*

Lost time for men and machines is at a minimum. If operating conditions change and further time can ever be saved, it will be apparent from information available. We have been unable to find any other method or system which furnishes such a wealth of information at a glance with such a small investment for installation or operation.

Let us have an industrial system specialist explain how McCaskey will pay its way from the beginning in your plant . . . or send you factual reports of McCaskey savings in several other well-known plants.

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COMBINATION CIRCULAR
CUTOFF *and* CHAMFERING TOOL

for Brown & Sharpe Automatic Screw Machines

Rarely will it be necessary to purchase *special* cutoff and chamfering tools for use on Brown & Sharpe Automatic Screw Machines. Weldon now offers a large line of such tools which can be *ordered from stock.* The tools in this new Weldon line cover a wide range of sizes to meet chamfering requirements to practically all diameters. A choice of two cutoff angles is offered—15° for steel or 23° for brass. Orders promptly filled through our local distributor or direct from factory stock.

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with List Numbers and Prices

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such a way the management could take a recognized 10% profit on a higher turnover, thus leaving little or no extra profit for the employees. To obtain and maintain the employees faith in the management, it would be necessary to guard the worker and show him how he was guarded against such a possibility.

All this jargon may appear to be off the track, but fundamentally it would appear to be impossible to go halfway by just getting only the poor, old, already overworked foreman interested in costs, when so very much more can be done by getting everyone interested — productive, non-productive and clerical.

The whole subject is riddled with little snags which would necessitate fresh company rules, but the goal to be reached is also full of admirable advantages, which makes the matter at least worthy of further discussion.

R. J. Webb
Cockfosters, Herts
England

•

SHOULD A FOREMAN BE BOSS OR GANG LEADER?

As I am a very interested reader of the articles in your magazine, I noted particularly the one entitled "How to Get Best Results From the Jig Borer," and agree that the mathematical part of the work should be done in the drafting room.

The above-named article would be very good for a shop foreman to read, namely: To give a little advice to his men instead of bawling them out continually and for no reason whatsoever. A little education along this line would harm no one and the company would be further ahead as it would be better able to keep its highly skilled men.

I know whereof I speak because I have had 36 years of experience as a tool and die maker, model maker, experimental worker, tool trouble-shooter, and general machinist. I am highly skilled and believe my foreman should be at least one point better in working knowledge.

I can cite my own case where the foreman did not even know the basic rules of the trade, but he *did* know someone influential enough to put him into the position of "shop foreman." After spending a couple of years trying to work under a foreman who didn't know what it was all about, I gave up and quit.

There are few enough skilled tool and die makers in the field. Perhaps you can readily understand why there are so few. Why don't the companies try putting a man in the position of

Perhaps you are developing a product in which hardened and precision ground parts will be important. Your requirements may be simple or they may demand a high degree of accuracy . . . closely controlled hardening or carburizing . . . or an exceptionally fine surface finish such as on the part shown above. Meeting such requirements is daily routine at Allied.

Specifications for the part illustrated, as an example, called for the use of forged AMS-6250 steel, selective carburized and hardened. No decarburization was permitted on any surfaces which were to remain soft. Aircraft quality finish without trace of tool marks was required. The intricacy of the part presented unusual machining problems which were quickly overcome by Allied production ingenuity.

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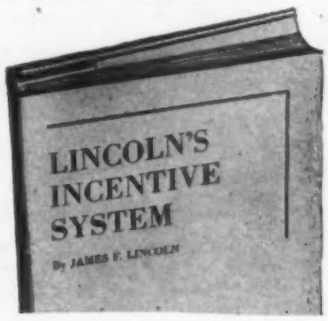

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foreman who really knows the score? I have found in too many cases that because a man's education is limited to the first or second year of high school, regardless of his skill and full knowledge of the work he is doing, he is not the one selected when an opening for shop foreman arises.

Michael J. Husenjik
Chicago, Ill.

"Quotes"

Good Tooling Cuts Cost

Better tooling offers the most practical means of holding down manufacturing costs in spite of mounting wage rates, Richard F. Moore, president of the National Tool and Die Manufacturers Association, told the association's Board of Directors recently, at its two-day session at the Hotel Pennsylvania, New York.

"Ingenuity in special tooling is the greatest of all cost reducers on production work," Mr. Moore said, referring to the specially designed dies, jigs, fixtures, cutting tools, molds, gages, and special machinery which make mass-production possible.

"The 3,000 contract tool and die shops have as vital a job to do in helping industry reach new peacetime levels as they had in making possible the records in war production that amazed the world.

"The greatest handicap faced by the special tooling industry is the continuing shortage of skilled tool and die sinkers. The association has developed an apprenticeship program especially adapted to the training of veterans, and is urging its widespread usage. By four years of carefully supervised work a junior journeyman can be developed. Further years of experience are required to make a top-flight tool and die maker. Such men are among the highest paid of all craftsmen."

•

Engineering Strides

Said M. W. Smith, vice president in charge of engineering, Westinghouse Electric Corporation, at the recent Machine Tool Forum at Pittsburgh:

"An impressive fact that often stands out in the course of research and development work is the knack of engineers to invent and fabricate the tools and equipment they find necessary for exploration of unchartered fields. An early and now familiar example is the network calculator, on which practically all conditions on power systems can be simulated by electrical constants on the calculating board and a reliable solution obtained quickly.

"An important advancement along these lines has recently been made by our engineers in development of the transient analyzer. This electrical brain provides the means of solving a variety of problems through the use of electrical circuits in which combinations of inductance, capacitance, and resistance can be connected in the proper relationships and proportions to represent faithfully the factors in the analogous problem to be solved.

"While the realms of mechanics, thermodynamics, electricity, hydraulics and other branches of science are all governed by their own set of provincial laws, fortunately there is such an orderliness in nature that the laws in one field are analogous to those in another. This fact makes it possible to solve many of the problems in allied fields by the use of the electrical analogue.

"While this analyzer cannot produce answers with decimal-point precision, it does give engineering solutions to a variety of problems in a small fraction of the time that would be required by other types of calculating means.

"A product is no better than the quality of the basic materials that make it up. These are the building blocks engineers use, and the search for new and better basic materials is always going on. The gas turbine, for example, is an old idea but it could not progress to a commercial stage until alloys capable of withstanding terrific heat were developed.

"It is unlikely that many servomechanisms and gyroscopic control developments made for military purposes will be directly applicable to industrial control, but the experience gained in developing and producing these exacting military devices might profitably be directed toward the solution of some of the machine tool application problems now facing us.

"Joint efforts will be most effective when there is a meeting of minds during the early stages of the development of new projects. Then is the time greatest help can be given in applying standard electrical equipment which affords the greatest possibilities of economy. On the other hand, if standard equipment cannot be used, the opportunity is thus afforded to get an early start in the modification of development of new equipment necessary to meet new requirements. To take full advantage of these possibilities will require frequent and regular exchange of visits."

SPECIALS!

. . . convincing evidence of manufacturing skill

● Industry today, more than ever before, has a definite need for many different types of non-standard fasteners . . . fasteners of unusual sizes, shapes and materials . . . fasteners which must be custom-made to perform vital jobs in complex manufactured products.

Typical of these "specials" are the stainless-steel-headed bumper bolts illustrated above.

The fact that all circle B fasteners are controlled from billet to bolt in one single plant—*the largest independent in the country*—naturally makes the Buffalo Bolt Company the logical starting point for any producer with a nut or bolt problem.

Standard or special, all circle B products have the same uniform controlled quality that serves to make your production more efficient . . . less costly.

DID YOU KNOW *that each of this battery of Buffalo Bolt roll threaders has a capacity of* 43,000 *bolts per working day?*

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	REctor 2-6560 · BErgen 3-1614	
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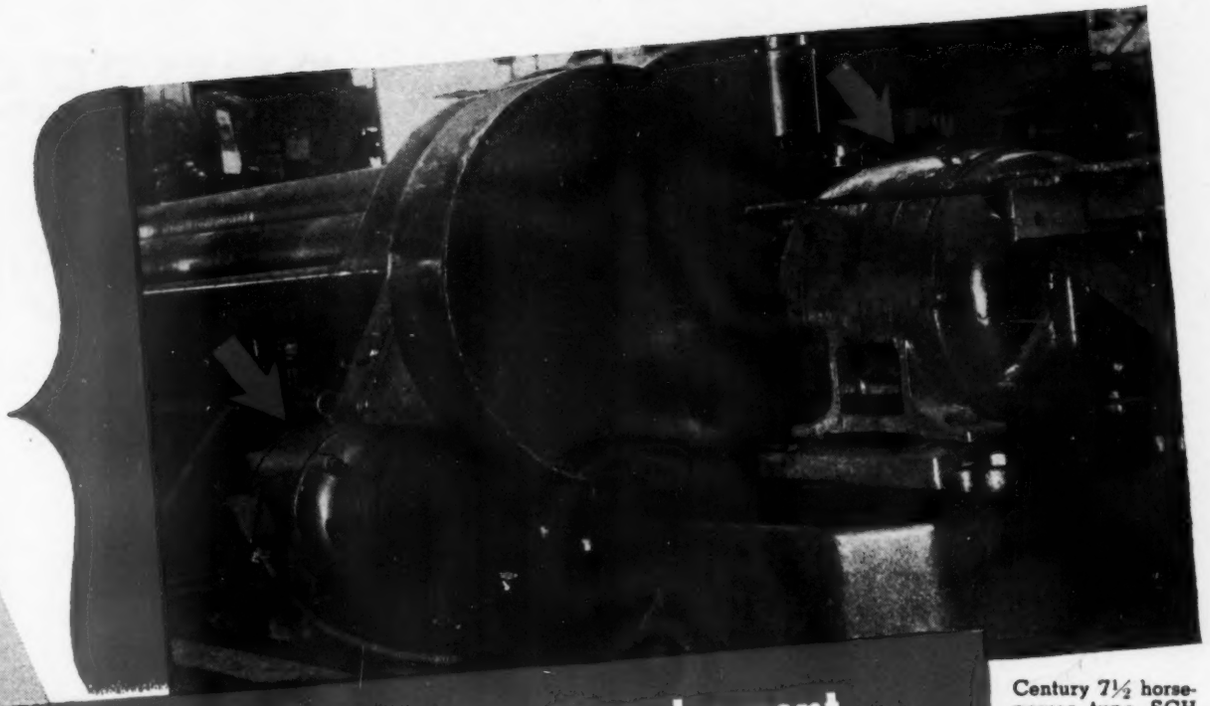

Century 7½ horsepower type SCH and 3 horsepower type SC motors driving a steel plate forming machine.

Whatever the Torque Requirement . . . There's a CENTURY MOTOR for the Job . . .

The motor application on the plate forming machine shown above is a good example of Century motors properly applied. There are two separate drives, each having a different power requirement.

The power rolls that force the steel plate through this machine require a motor that starts against a heavy load. A Century type SCH motor with high starting torque and low starting current is used.

The adjustable roll that controls the curvature of the plate requires a standard general purpose Century type SC motor with normal starting torque.

Correct application of these two motors means that the steel plate roller gives top performance and a maximum of output.

If your machines require electric motors from 1/20 to 600 horsepower, investigate Century. Specify Century motors on all your electrically powered equipment. Engineered to the functional characteristics of the machines they drive to assure top performance — Century motors are a vital factor in producing a better product at a lower cost.

Century C MOTORS

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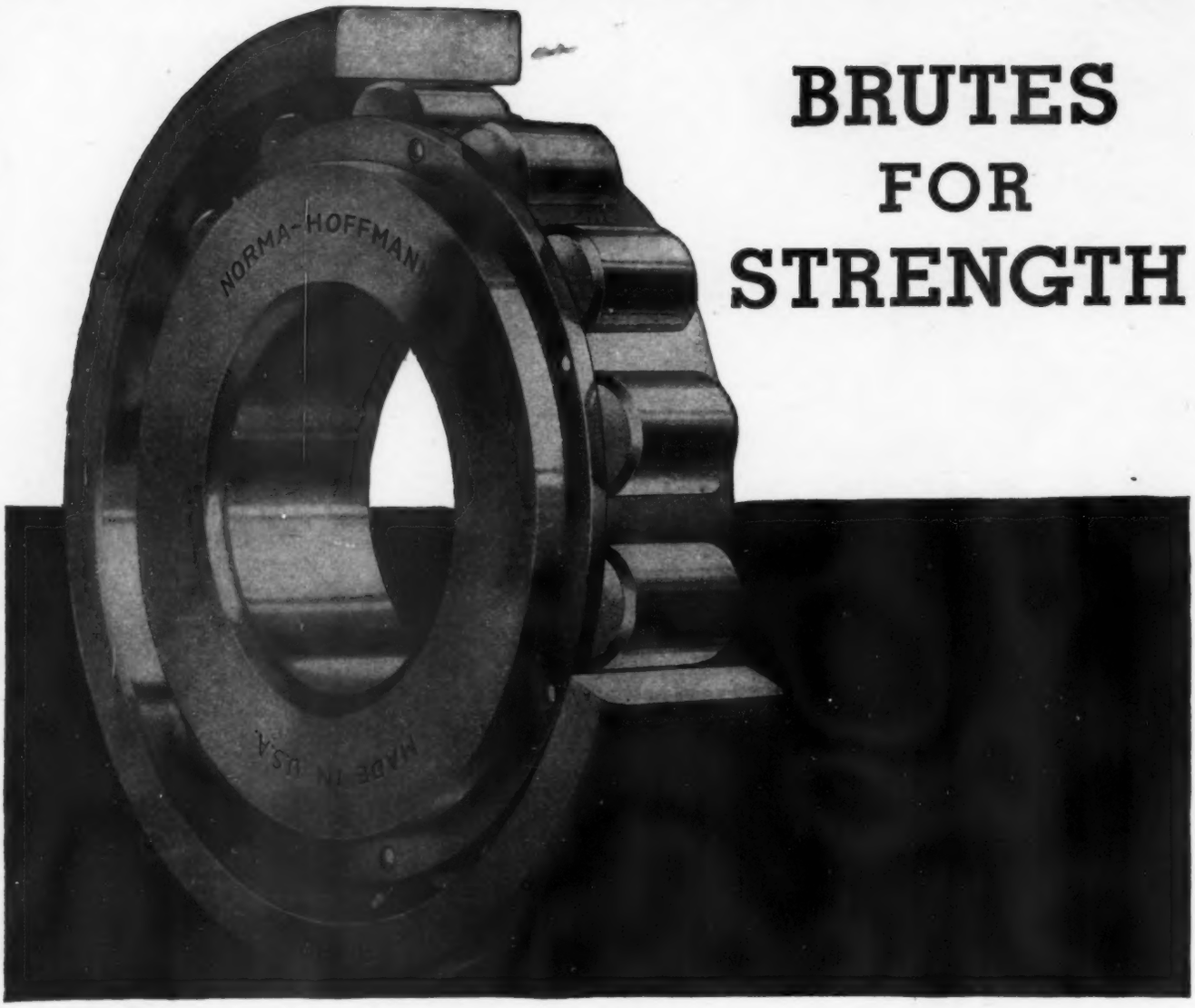

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MACHINES AND ATTACHMENTS

1 PRESSES—Williams-White & Co., Moline, Ill. 40-page catalog illustrates and describes some of the machinery this company manufactures for the bending, forming, forging, and rolling of metal.

2 TOOL GRINDERS—Willey's Carbide Tool Co., Detroit 1, Mich. 4-page folder describes Model 50-A tool grinder for wet and dry grinding of carbide-tipped tools.

3 HAND SCREW MACHINES — The wade Tool Co., Waltham, 54, Mass. 12-page folder covers Models 5 and 7 hand screw machines designed for second-operation work. Contains detailed views, drawings and descriptions.

4 PLANER—Rockford Machine Tool Co., Rockford, Ill. 16-page bulletin 110 describes Hy-Draulic openside planer. Drawings and detailed views accompany facts about design, construction, and operation.

5 DRILL GRINDERS—Black Diamond Saw and Machine Works, Inc., Natick, Mass. 4-page bulletin No. 744 covers precision drill grinders which come in three sizes. Descriptions, specifications, and attachments are included.

6 TAP GRINDER—Edward Blake Co., Newton Centre, Mass. 8-page bulletin No. 544A covers Nos. 1 and 2 tap grinders. Large illustrations and detailed drawings show construction.

7 HYDRAULIC GRINDING MACHINES—The Grenby Mfg. Co., Plainville, Conn. 32-page booklet describes cylindrical grinders, Series EG-103 and IG-103. Includes construction details, operating instructions, and lists of parts and accessories.

8 METAL DISINTEGRATION—Elox Corp., Clawson, Mich. 4-page folder covers Models G, J, and K electrical disintegraters for removing broken reamers, taps, drills, and studs.

9 MILLING MACHINE—Aircraft Machinery Corp., Burbank, Calif. 4-page bulletin contains complete description and specifications of bench-type mill of reduced size.

10 CONTOUR SAWING—The DoAll Co., Minneapolis 4, Minn. 264-page book "Instruction Program, DoAll Machines, Tools, Gages," Vol. 1, covers the technique of contour sawing. Intended for school use, the book will also be valuable to companies for trainee instruction. One section covers conventional, the other high-speed sawing procedures.

11 BLAST CLEANING—American Foundry Equipment Co., Mishawaka, Ind. 16-page catalog No. 264 gives complete information on 60x96 in. Wheelabrator Tumblast. This machine has capacity of 63 cu. ft. and will clean 4,000 lb. of steel castings in 15 min.

TOOLS AND ACCESSORIES

12 MULTI-SWIVEL VISE—Master Tool Co., Boston, Mass. 6-page folder describes flexible vise which may be used as a plain-flanged, plain-swivel, and a multi-swivel vise.

13 CUT-OFF TOOLS—Anthony Tool Co., San Antonio, Texas. 6-page bulletin describes special cut-off tools said to take only 5 to 50% of the time normally consumed for lathe cut-off operations. Power feed is used.

14 PRESS SAFETY DEVICE—Strand Mfg. Co., Inc., Chicago 6, Ill. 4-page bulletin describes "Safguard" sweep arm which is synchronized with press stroke and speed to safely clear and danger area when ram starts downward.

15 DIAMOND TOOLS—F. F. Gilmore & Co., Boston, Mass. 32-page catalog No. 45 covers diamond tools for truing grinding wheels. Many illustrations are included.

16 FILING MACHINE—All American Tool & Mfg. Co., Chicago 14, Ill. 6-page folder illustrates and describes a filing machine for die-makers. Clamp makes possible instant adjustment so that an accurate vertical position of the file is obtained.

17 TAP HEADS—R. G. Haskins Co., Chicago 12, Ill. 8-page bulletin illustrates and describes tap heads for mounting in drill presses. Three sizes are available.

18 NON-SPARKING TOOLS—Ampco Metal, Inc., Milwaukee 4, Wisconsin. 28-page catalog covers complete line of safety tools made of Ampco metal for use in atmospheres where sparks are dangerous.

19 PLUG GAGES—United Precision Products Co., Chicago 18, Ill. 42-page catalog covers "DubLife" reversible plug gages and other precision gages. Plugs are reversible in the handle giving twice the gage life.

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20 END MILLS—Nelco Tool Co., Inc., Brooklyn 31, N. Y. 4-page bulletin illustrates, gives data and prices on standard Carboloy-tipped end mills.

21 TESTING INSTRUMENTS—Steel City Testing Laboratory, Detroit 4, Mich. 6 catalog pages cover six different models of Brinell testing machines, including manually operated and portable types, and a universal model for tensile, traverse, and compression tests.

22 TOOLS—The Staples Tool Co., Cincinnati 25, Ohio. Catalog lists prices and specifications of all the company's tools. Includes technical sections on reamer usage and sharpening, reconditioning expansion reamers, and requirements for designing special tools.

HEAT-TREATING AND WELDING

23 FURNACES—W. S. Rockwell Co., Fairfield, Conn. 6-page bulletin No. 421 explains belt-conveyor furnaces, describes furnace for heat-processing a variety of products under wide range of requirements. Many typical installations are shown.

24 HARD SURFACING—Metal & Thermit Corp., New York 5, N. Y. 16-page bulletin gives information on use of Hardex electrodes for building up surfaces. Temperature and cooling rates, selection of proper rods, and welding techniques are discussed.

25 COPPER-ALLOY WELDING—C. E. Phillips & Co., Detroit 8, Mich. 32-page booklet "Welding and Brazing Copper and Copper Alloys" gives detailed discussion of materials and processes and recommended procedures. Recommends preferred materials to be used with each method.

PLANT SERVICE EQUIPMENT

26 NON-SLIP FLOORS—Norton Co., Worcester 6, Mass. 8-page bulletin describes several types of flooring which is suited to a variety of applications and retains its non-slip protection even when wet.

27 MATERIALS HANDLING—Robins Conveyors, Inc., Passaic, N. J. 8-page bulletin describes Car Shakeout which unloads hopper-bottom railroad cars quickly. Seismic action does the job in as little as 90 sec.

PARTS AND MATERIALS

28 PUMPS—Marco Co., Inc., Wilmington, Del. 20-page bulletin describes the Flow-Master line of processing equipment, including transferring, metering and proportioning pumps.

29 COOLANT—The Cincinnati Milling Machine Co., Cimcool Div., Cincinnati 9, Ohio. 8-page bulletin "What is Cimcool?" describes this cutting fluid designed for milling, turning, drilling, and grinding operations. This coolant is said to be applicable to practically all machine operations.

30 SHAFT DATA—The De Laval Steam Turbine Co., Worm Gear Div., Trenton 2, N. J. 16-page booklet gives useful data for determining stresses, torques, bending moments, and deflection in various types of steel shafts.

31 PIPE COUPLING—Dresser Mfg. Div., Bradford, Pa. 12-page bulletin describes and gives applications for couplings and repair devices for joining and repairing pipes.

32 ZINC PLATING—Hanson-Van Winkle-Munning Co., Matawan, N. J. 8-page bulletin describes and gives instructions for using S-B Process for producing pure unalloyed electrolytic zinc deposits which are highly protective and satin bright to bright in color.

33 NEOCETA—Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md. 8-page folder tells about the paint brush problem and describes Neoceta, a bristle that has all the advantages of pure hog bristles plus uniform quality and ready availability.

34 RING GASKETS—The Steel Improvement & Forge Co., Cleveland 14, Ohio. 8-page bulletin describes and lists sizes of ring gaskets for high-pressure pipe lines.

35 MIDGET PUMPS—Eastern Engineering Co., New Haven, Conn. 20-page folder contains description and illustration of line of small, compact pumps including many new models.

36 DRYSEAL PIPE THREADS — The Weatherhead Co., Cleveland, Ohio. 8-page booklet explains the improved pipe thread known as Dryseal recently adopted as standard by the SAE.

37 MOTOR SERVICE—Westinghouse Electric Corp., Pittsburgh 30, Pa. 12-page bulletin describes three service plans to provide 100% service coverage for fractional horsepower motors.

38 PROTECTIVE COATINGS—Peninsular Chemical Products Co., Van Dyke, Mich. 4-page bulletin describes Pen-Kote for masking parts prior to plating and for insulation of plating racks. Types are available for a variety of requirements.

39 PLASTIC FORMING—Tennessee Eastman Corp., New York 16, N. Y. 12-page booklet describes processes of forming articles from extruded Tenite sheeting.

40 GEAR LUBRICATION—Socony-Vacuum Oil Co., Inc., New York, N. Y. 60-page booklet "Gears and Their Lubrication" gives fundamental data on gears and lubrication requirements for both closed and open gears.

41 VOLTAGE TRANSFORMER—Superior Electric Co., Bristol, Conn. 4-page bulletin No. 20 illustrates and describes Type 20 Powerstat variable voltage transformer. This is a smaller unit retaining the characteristics of larger models.

42 MEEHANITE—Meehanite Metal Corp., New Rochelle, N. Y. 4-page folder Form DM-145 describes typical application case histories including thread gages, upsetting dies, and precision machinery.

43 INSPECTION—The Faxfilm Co., Cleveland 13, Ohio. 8-page bulletin explains method of making detailed inspection of surfaces without photography. Faxfilm is pressed to surface wet with solvents, then mounted in frame, is ready for projection.

44 LUBRICATION—Lubriplate Div. of Fiske Brothers Refining Co., Newark 5, N. J. 28-page booklet explains development, describes properties, and discusses applications of Lubriplate. Recommendations are made for type of lubricant to use on various applications.

45 SPEED REDUCER—Cleveland Worm & Gear Co., Cleveland 4, Ohio. 4-page bulletin No. 517 shows application of worm-gear speed reducers to mixing and grinding equipment.

46 SYNTHETIC RUBBER—Dow Corning Corp., Midland, Mich. 4-page bulletin describes Silastic, an almost entirely inorganic substance which has better heat resistance than organic rubbers.

47 TUBING—Bentley-Harris Mfg. Co., Conshohocken, Pa. 1-page catalog insert gives sample and describes fiberglas tubing for electrical insulation. This tubing does not react to heat conducted through wire.

MISCELLANEOUS

48 CENTENNIAL—Wheelock, Lovejoy & Co., Inc., Cambridge, Mass. 48-page brochure "100 Years of Continuous Service to Industry" describes development of company and pictures many company employees.

49 PRECISION CASTINGS—Austenal Laboratories, Inc., New York 16, N. Y. 8-page bulletin describes microcast process for producing castings of intricate design to accurate dimensions.

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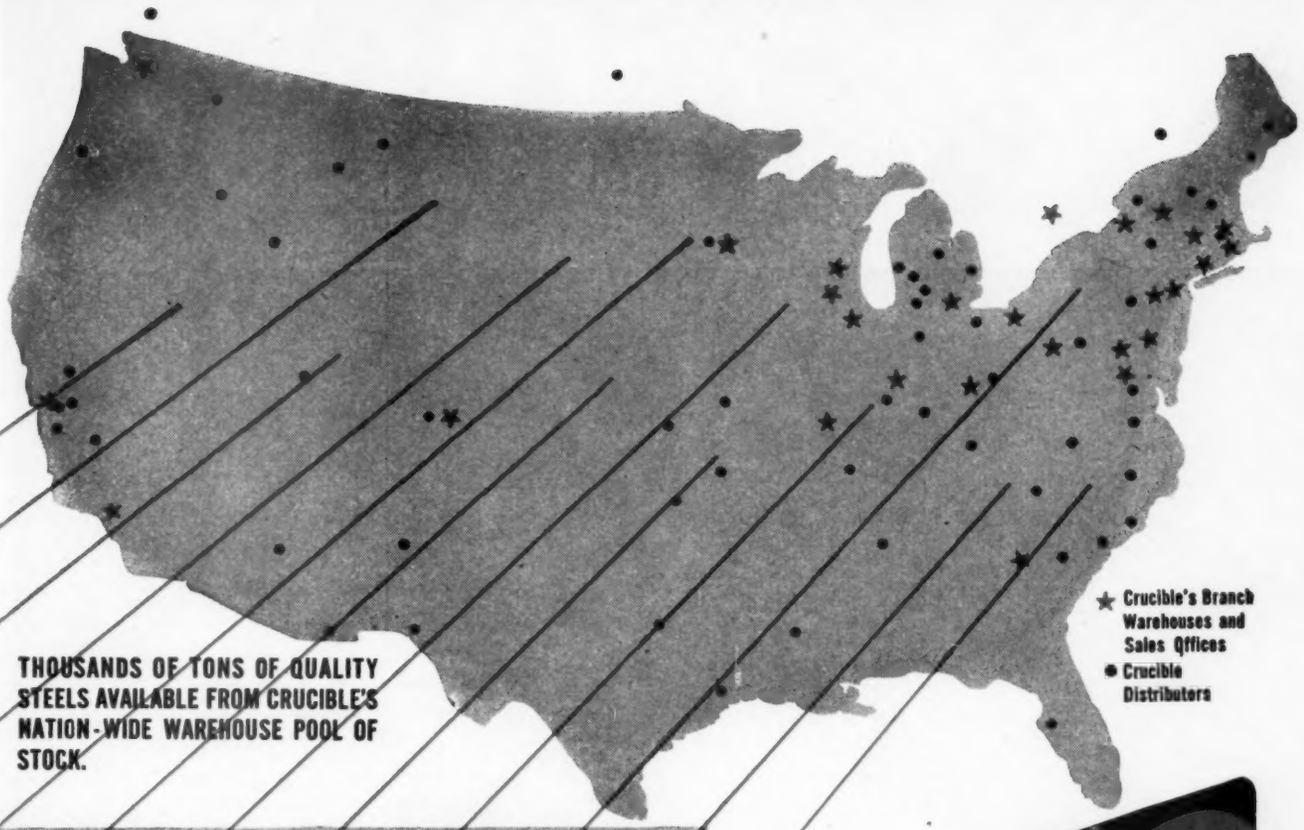

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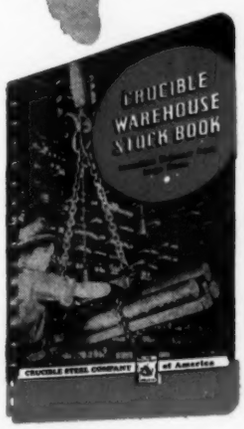

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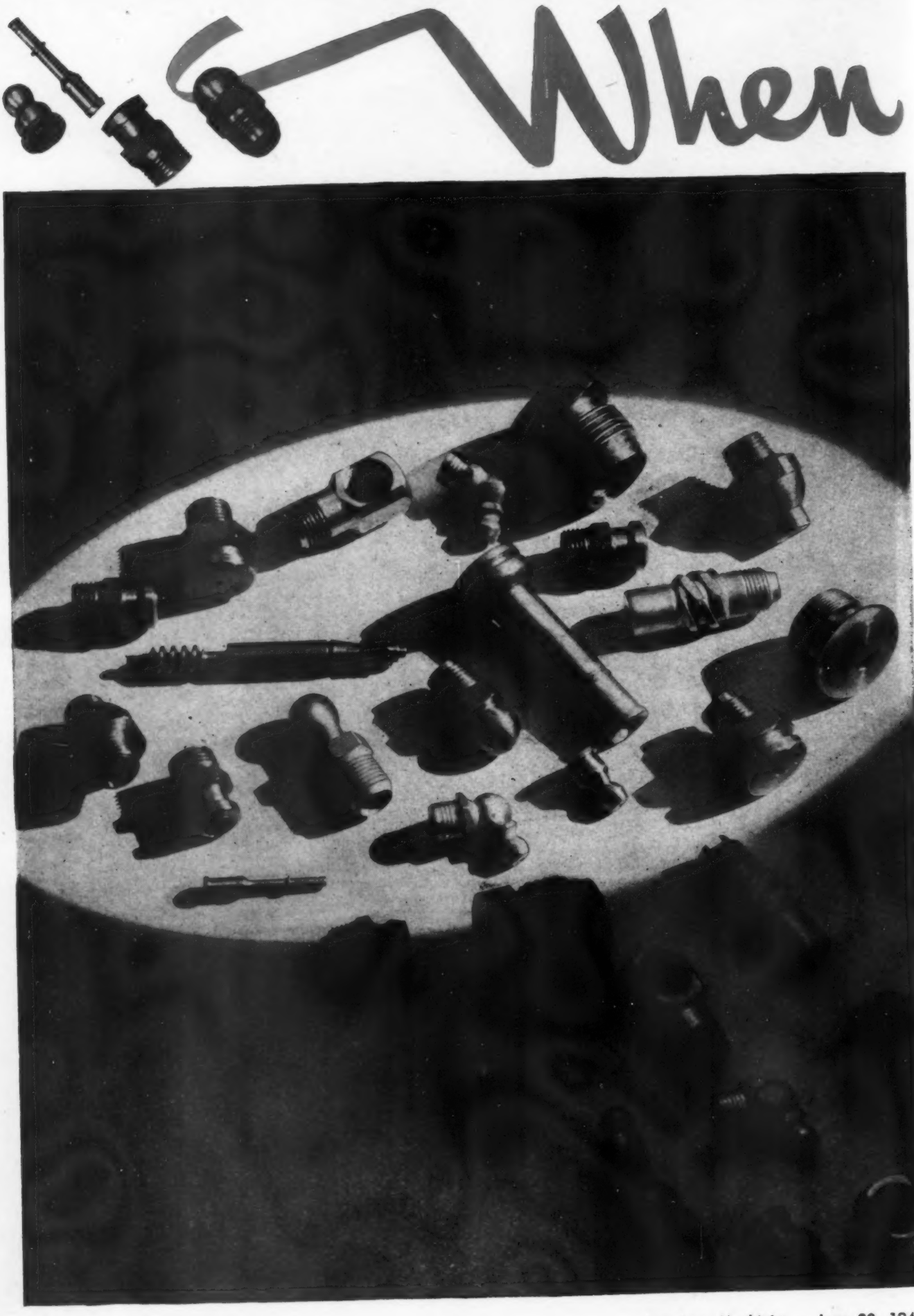
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Large easy-to-read markings make it a simple job to choose the correct Clemson blade for every job.
It's the finest grade of high-speed steel scientifically heat treated to give Clemson blades longer wearing and cutting qualities.
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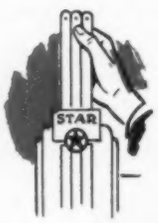

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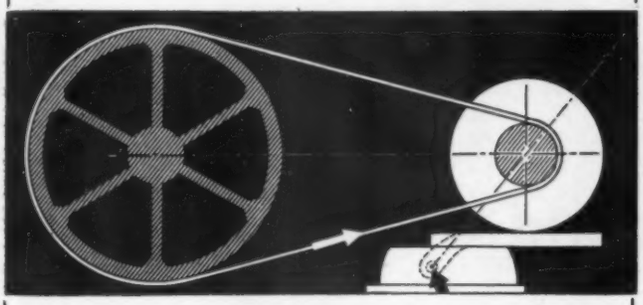

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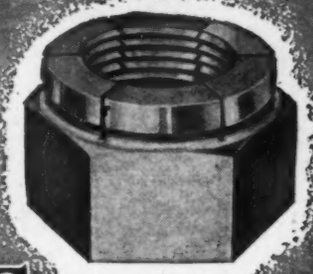

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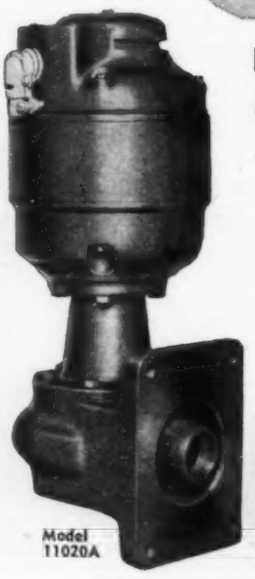

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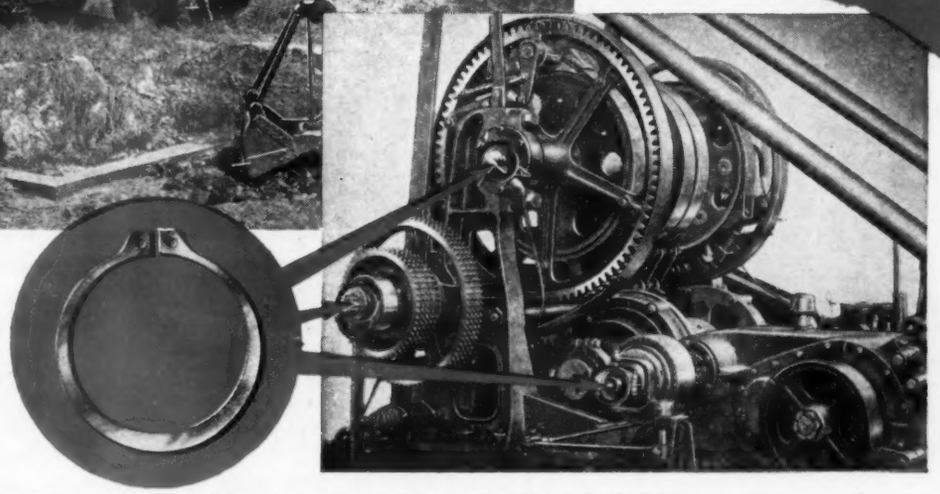

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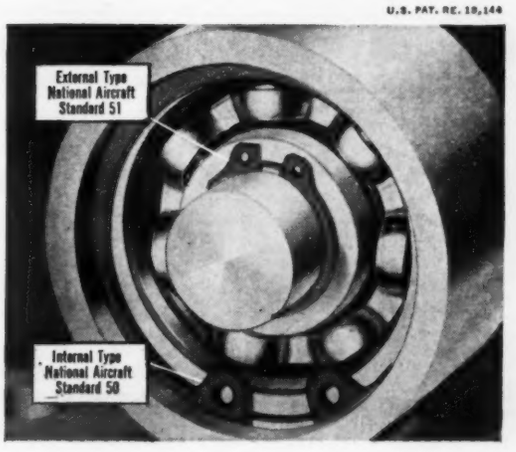

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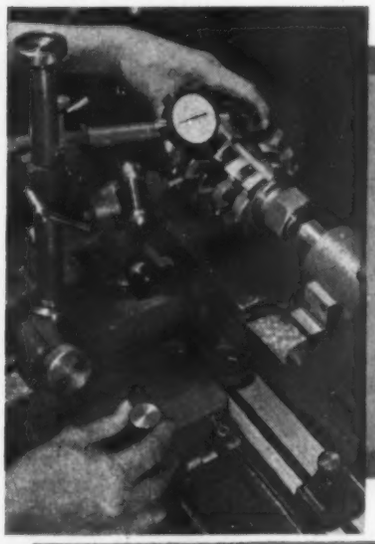
with Minimum T.A.E. permit INCREASED SPEEDS *and* HORSEPOWER

THE smaller stresses that result from holding T.A.E. (TOTAL ACCUMULATED ERROR) to a minimum, as in Sier-Bath Gears, have made it possible for machinery manufacturers to increase horsepower loads and speeds substantially. Longer gear life, quieter operation and increased continuous service are also obtained. Let Sier-Bath submit a quotation on your gears, today.



Even the cutting tools at Sier-Bath are checked in the constant-temperature checking room. Gear checks from which every manual and visual error is eliminated are sine line lead, sine line involute, concentricity, tooth spacing, and gear action.

GEAR RANGE

Spur, helical and worm gears to 48"; worms to 12"; straight tooth bevel gears 24 pitch to 3 pitch. Gears shaved from 1" to 24" inclusive. Worm gears, precision ground on J. & L. thread grinder to extremely close tolerances.

SIER-BATH GEAR COMPANY, INC.
9246 HUDSON BOULEVARD, NORTH BERGEN, N. J.

Try ATLANTIC

on that gear order

Many others have, to their lasting satisfaction. Full equipment, splendidly trained personnel, precision inspection, in spurs, helicals, worms, bevels, herringbones. Any gear material including Micarta or non-metallic Bakelite. Any quantity. Any size to 60". Send us your specifications.

Send us your blueprints or samples for our quotations and delivery dates.

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NEW YORK 12, N. Y.
Phone: CAnal 6-1440

Giant KEYSEATERS

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

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BAUMBACH *The* DIE SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

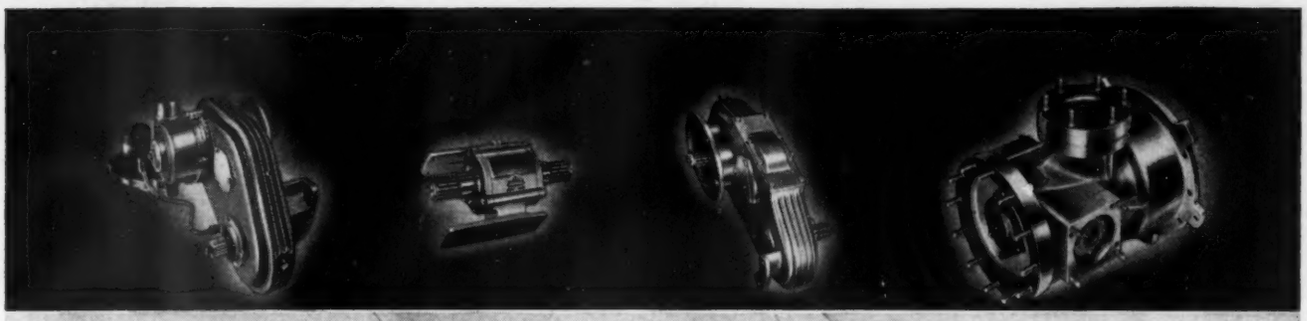
E. A. BAUMBACH MFG. CO., 1804 S. Kilbourn Ave., Chicago 23, Ill.

BILGRAM BEVEL GEARS

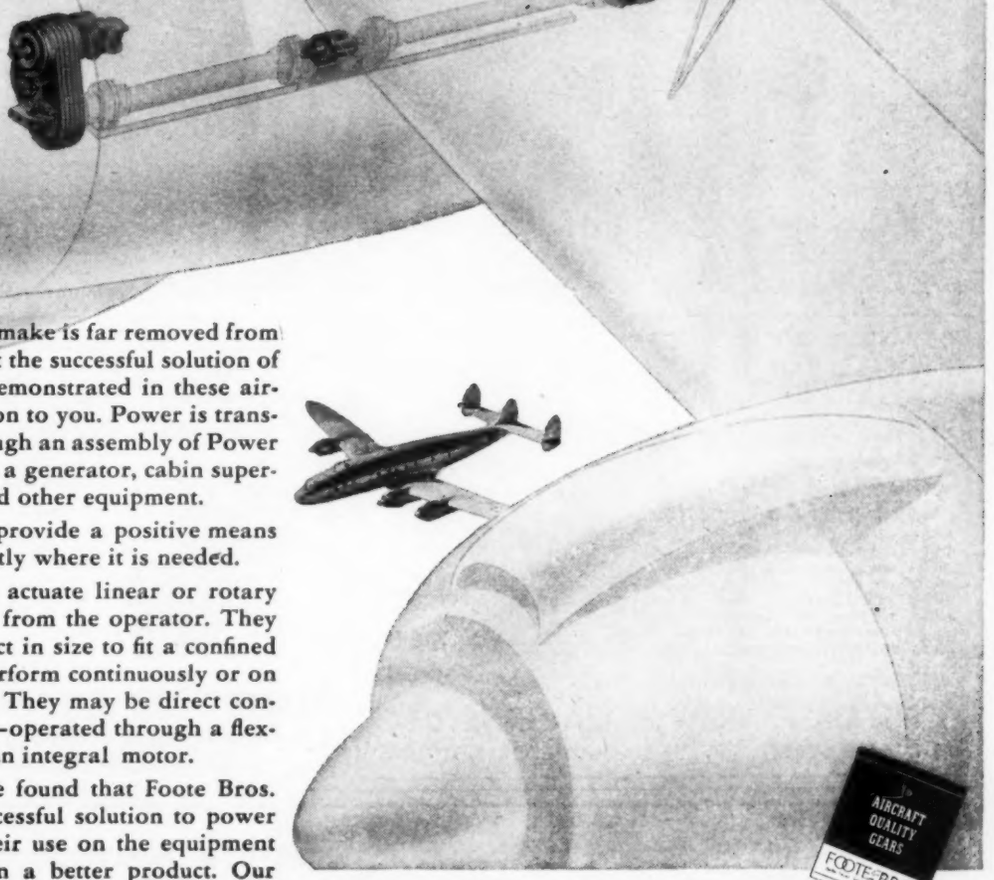
Straight — Spiral Teeth

ALL TYPES
ALL MATERIALS

BILGRAM GEAR & MACHINE WORKS
1217-35 Spring Garden, Philadelphia, Pa.



what lesson can you learn from a mighty *Air Transport?*



Perhaps the equipment you make is far removed from Lockheed air transports, but the successful solution of the application of power demonstrated in these airplanes may offer a suggestion to you. Power is transmitted from the engine through an assembly of Power Units. This assembly drives a generator, cabin supercharger, hydraulic pump and other equipment.

Foote Bros. Power Units provide a positive means of applying this power exactly where it is needed.

These compact units can actuate linear or rotary motion at remote distances from the operator. They are light in weight—compact in size to fit a confined space envelope—and can perform continuously or on a predetermined time cycle. They may be direct connected to the power source—operated through a flexible shaft—or powered by an integral motor.

Many manufacturers have found that Foote Bros. Power Units provide a successful solution to power transmission problems. Their use on the equipment you manufacture may mean a better product. Our engineers will gladly work with your designers.

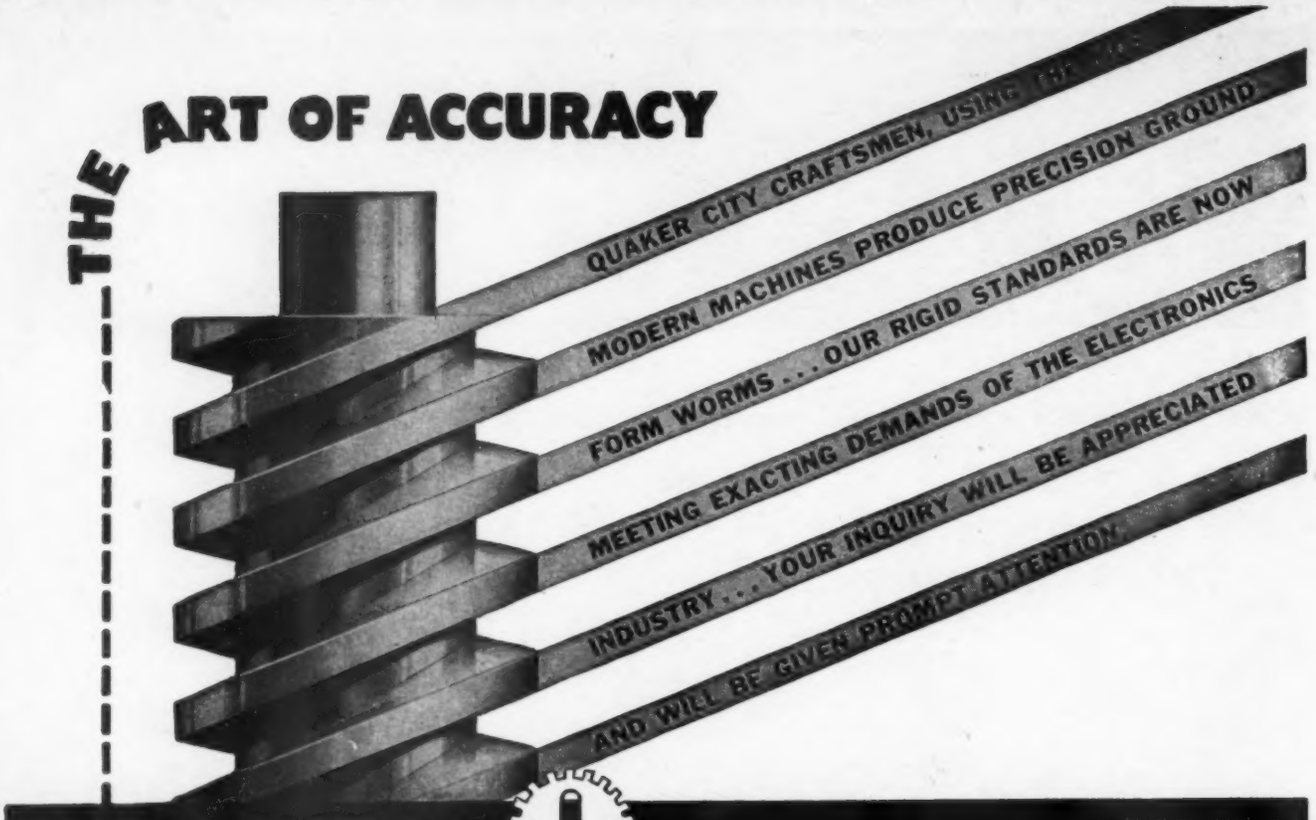
FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. WESTERN BLVD. • CHICAGO 9, ILL.

FOOTE BROS.

Better Power Transmission Through Better Gears

A recently issued bulletin on Power Units giving complete engineering data on "packages of power" will be sent on request. Also available is a bulletin on Aircraft Quality Gears. Write for your copies today.

THE ART OF ACCURACY


QUAKER CITY CRAFTSMEN, USING THE
MODERN MACHINES PRODUCE PRECISION GROUND
FORM WORMS . . . OUR RIGID STANDARDS ARE NOW
MEETING EXACTING DEMANDS OF THE ELECTRONICS
INDUSTRY . . . YOUR INQUIRY WILL BE APPRECIATED
AND WILL BE GIVEN PROMPT ATTENTION.

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QUAKER CITY GEAR WORKS, INC.

Available for IMMEDIATE DELIVERY

HUB Power Presses

assure faster, small parts production

You can cut time and cost on post-war production. These fast, rugged power presses of 4½, 6 and 15-ton capacity will stamp, punch and rivet. A steel table mounting, and foot-lever control are features which contribute to their all-round utility and convenience.

Send for Circulars and Prices.

WILLIAM F. BREWER MACHINE CO.
75 LAUREL STREET **HARTFORD 6, CONN.**

QUALITY GEARS CUT TO ORDER

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

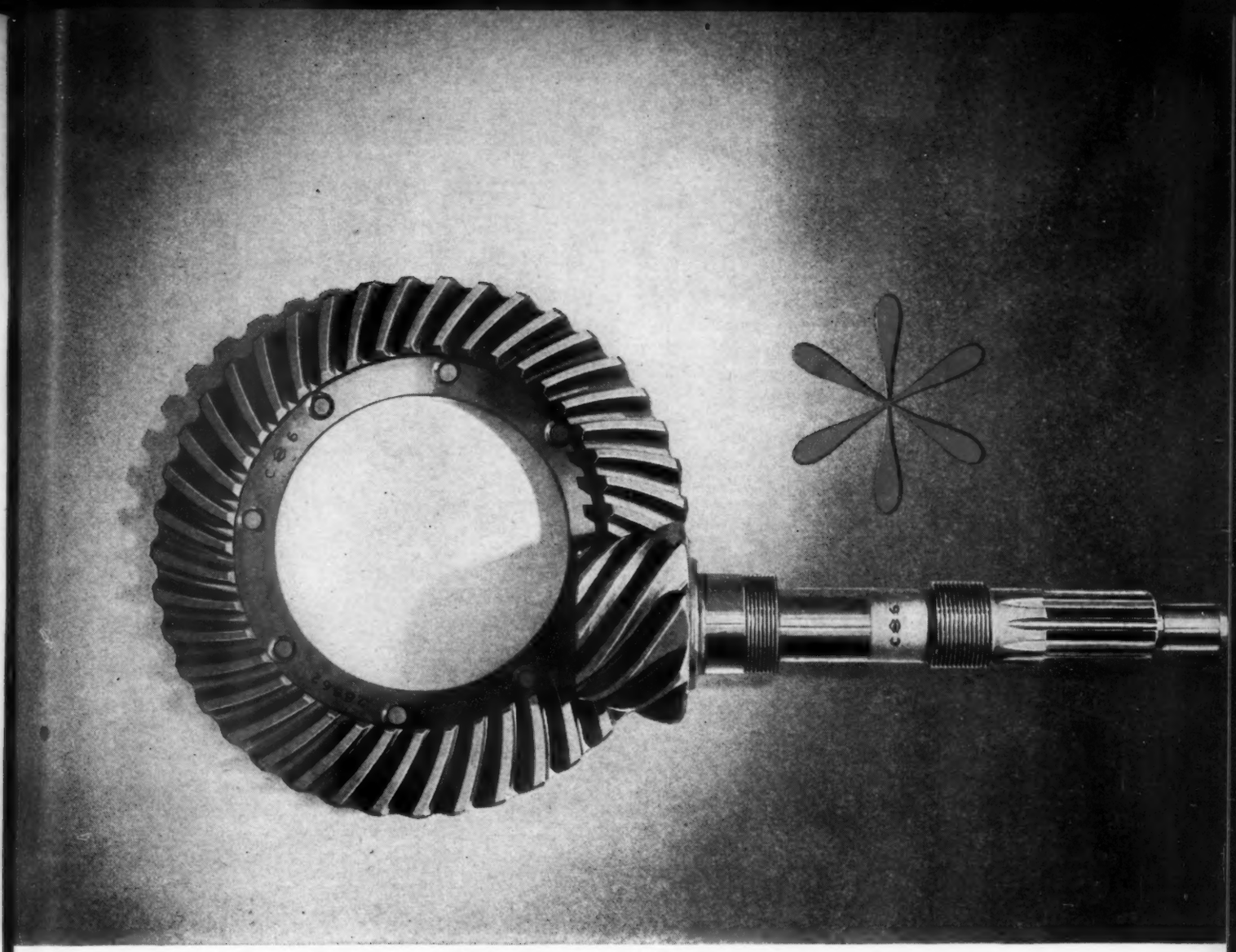
MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston, Mass.

Better Gear Products

GANSCHOW

CUT GEARS (MEMBER OF AGMA) ALL TYPES

GANSCHOW GEAR CO., 14 N. Morgan Street, CHICAGO 7.



Plan to Gear-up for Silence

CHECK DESIGN... practical high-efficiency gear design requires the kind of specialized engineering skill and experience that assures silent, effective transmission of power on a long-time basis. Double Diamond Engineers are ready to help you plan and design your gear, gear-shaft and power transmission equipment. Use this consultation service any time.

CHECK PRODUCTION... it's one thing to custom build top quality into just a few gear sets... but it's another matter to maintain precision standards in quantity production. Specify Double Diamond and you are assured of precision gears on a production basis *comparable in long-lasting smoothness of action to the jewel movement in finest instruments.*

CHECK PRODUCT... design and production mean nothing *unless* you can be sure the finished gears provide smooth long life and trouble-free service.

Double Diamond Gears with the famous "jewel movement" are your assurance of quick, correct assembly and long-term satisfaction in the finished product.

AUTOMOTIVE GEAR WORKS, INC., RICHMOND, INDIANA

DOUBLE DIAMOND TRADE MARK GEARS

*the gears with the "JEWEL MOVEMENT"**

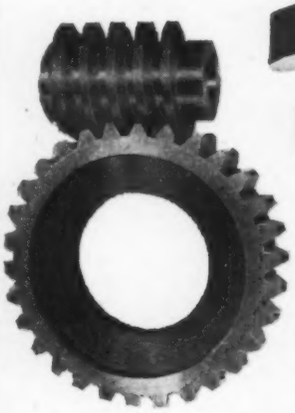
FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS

FASTER, SAFER, SMOOTHER

Cincinnati GEARS

GOOD GEARS

ONLY...



When the designers and engineers want speed, together with smoothness, safety and performance, they specify Cincinnati GEARS, GOOD GEARS ONLY.

Each Cincinnati Gear is made to your specifications to meet your particular requirements. For those really important jobs where performance counts . . . insist on the right gear for each job . . . get Cincinnati Gears.

- SPUR
- BEVEL
- HELICAL
- SPLINE
- WORM
- SPECIAL

THE CINCINNATI GEAR COMPANY

"Gears . . Good Gears Only"

Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio

YOUR REQUIREMENTS

assured by

Our 69-Year Experience

Grant "know-how" in making and supplying gears is at your service. Whether you require a single "special" or stock gears in quantity, it will be to your advantage to submit your requirements to "Grant" for quotation and delivery date. We are in position to render prompt service.

GRANT GEAR WORKS

BOSTON, MASS.

ESTABLISHED 1877 — GEAR — BY GEO. B. GRANT

GEAR CUTTING MACHINES

New Design

New Features

New Advantages

NEWARK GEAR CUTTING MACHINE CO.

69 Prospect Street, NEWARK 5, NEW JERSEY

FRANK E. EBERHARDT, *President*

GEARS TO ORDER

Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly.*

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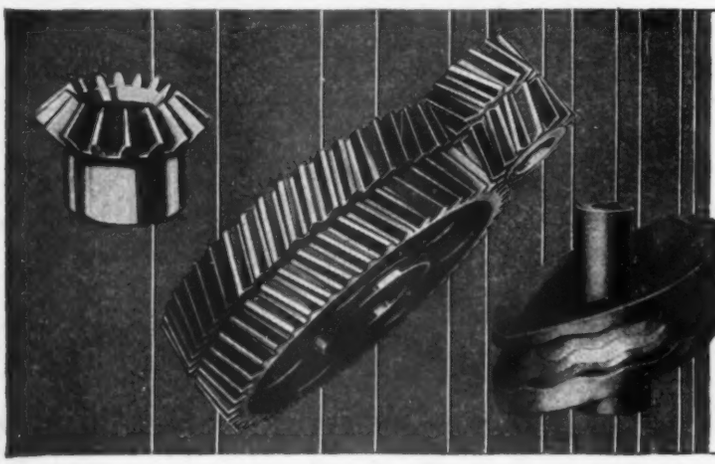
Bristol, Tennessee



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***from* "HARTFORD"**

GEARS of every description cut to order

GEAR, CAM and THREAD grinding

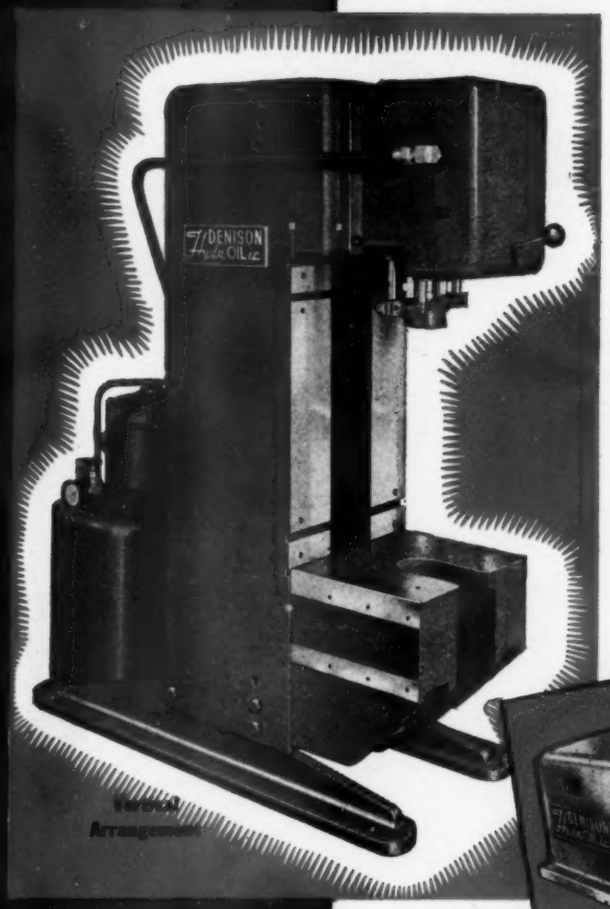
AERONAUTICAL PARTS on contract basis

Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

THE HARTFORD SPECIAL MACHINERY COMPANY

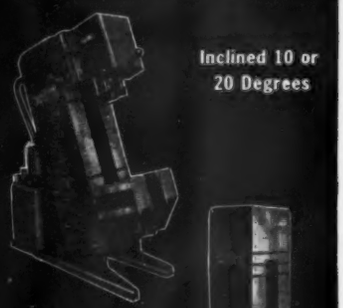
HARTFORD CONNECTICUT

Radically NEW Design
MULTIPLIES PRESS FLEXIBILITY!



MULTI-UNIT Hydroilic PRESS

A news-making improvement in machine tool design! A Denison hydraulic press built in separate, self-contained, specially designed components that achieve two striking advantages! First, they combine into the highly flexible MULTI-UNIT press, which can be set up in a variety of ways to meet many different needs. Second, your engineers can quickly and economically adapt individual MULTI-UNIT components to your own special machines or equipment!



MULTI-UNITS include the Pumping Unit, Power Head, Standard Frame, and Bolster. The Power Head, available in seven models, offers an amazing variety of ram actions, including manual or automatic control, rapid traverse and regulative pressing speed, automatically repeated pressure strokes, automatic ram cycling, and the now-famous Vibratory HydrOILic Pressure. Ram pressures are closely limitable up to 4 or 6 tons. Ram strokes are regulative between ½ inch and 6 inches.

The Standard Frame is drilled and keyed to permit a variety of bolster and Power Head adjustments, and features a choice of legs and "feet" that adapt the press to four different positions—horizontal, vertical, and at 10 or 20 degree inclines. Standard interlocking accessories, such as indexing tables and ejection cylinders, are applicable to these Multi-Units.

Write today for full details on this sensationally new production aid!

The DENISON Engineering Co.
1164 Dublin Rd.
Columbus 16, Ohio

HydrOILic INDUSTRY'S RIGHT

DENISON EQUIPMENT in APPLIED Hydr OILics

A TOUGH GRIND

. . . but here is a press that can take it!

The 2200-ton press illustrated is a self-contained unit with adjustable pressure control which assures maximum flexibility in producing abrasive wheels of various sizes and types.

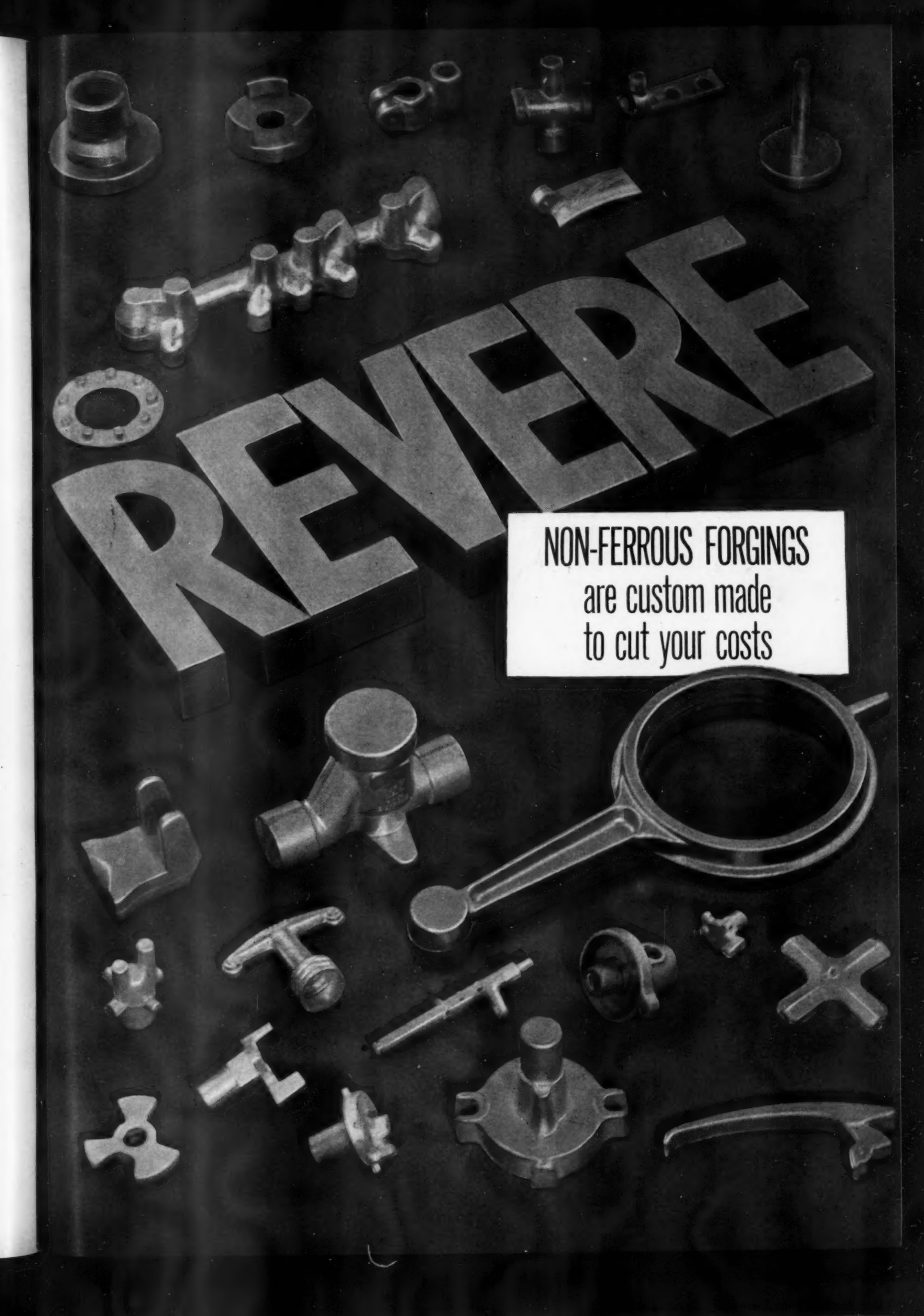
Grinding wheel production is rough on a press because the air around the press is constantly laden with abrasive dust. In spite of this, the Lake Erie press shown above has been turning out quality grinding wheels at a steady pace for six years at the Lackawanna, N. Y., plant of the Electro Refractories and Alloys Corp.

During the war years, this press worked 24 hours a day, seven days a week. Aside from routine servicing, about the only maintenance required was to true up the wear plates from time to time. The fine service-record of this sturdy press in producing thousands of grinding wheels is typical of the stamina and reliability of all Lake Erie presses. It will pay you to consult Lake Erie about your hydraulic press requirements.

LAKE ERIE ENGINEERING CORP.
507 Woodward Ave., Buffalo 17, N. Y.

Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses — all sizes and types — metal working . . . processing . . . plastic molding . . . rubber vulcanizing . . . stereotyping . . . special purpose.


REVERE
NON-FERROUS FORGINGS
are custom made
to cut your costs

PRODUCT IMPROVEMENT PLUS PRODUCTION ECONOMY

REVERE Non-Ferrous Forgings can both improve your product, and cut your manufacturing costs. Product improvement is due to the fact that these forgings have increased strength-weight ratios, and hence weight reduction may be possible. Complicated parts previously built up of several pieces may be produced in a single piece, for greater strength, better appearance, and less cost. Revere Forgings are accurate in dimensions, so that machining is reduced considerably, and along with it, machine time, scrap and rejects. Thus these forgings can solve many production problems, open bottlenecks, and in addition reduce your costs.

Increased Strength

In non-ferrous die-pressed forging, the heated metal is placed between dies, and tremendous pressure forces the metal into the desired form. This produces a fine, close grain structure, greatly increasing tensile strength.

"Twice Wrought"

Revere Forgings are forged from Revere Extruded material. Thus the metal has attained the greatest possible density through being worked twice under the tremendous pressures employed in each operation. The result is the highest tensile strength, toughness and fatigue resistance possibly obtainable in the metal or alloy. A few alloys are heat-treatable if desired.

Better Appearance

Surfaces are good. Small design details such as trade-marks, model numbers and names can be held sharp and true.

Non-Porous

Being uniform in density and without blow-holes or similar defects, Revere Forgings are impervious to oils, other liquids, and gases. Hence they are widely used in chemical plants, oil lines, refrigeration and other gas apparatus.

Speedy Machining

The denseness and uniformity of the metal makes possible higher machining speeds. The complete absence of sand inclusions makes tools give longer runs before re-grinding.

Plating

Any of the following finishes may be applied to Revere Copper and Copper Alloy Forgings with excellent results: Pickling, Bright Dip, Satin Dip, Bright Polish, Lead Dip, Cadmium Plate, Nickel Plate, Copper Plate, Chromium Plate, Silver Plate, Gold Plate. For high-quality plating it is necessary to give the surface a preliminary polish, but the cost of this is low because of the relatively smooth surface of the forging. Plating is possible on aluminum and magnesium but pickling or anodizing of these alloys usually is preferable and sufficient.

Dimensions

Maximum and minimum dimensions and tolerances depend on the alloy and the design of the part. Revere can now produce larger forgings than ever before, up to 30" in the largest dimension in some cases.

Long Experience

Revere was a pioneer in die-pressing hot non-ferrous metals into high-quality forgings. Since 1922 we have been developing machines and methods for that purpose, and today the Revere forging techniques produce exceptional results. Another important Revere asset is the fact that we have had 145 years of experience with metals. Most of the alloys Revere forges are produced in Revere's own plant, under close laboratory control, and the forgings themselves are constantly inspected for size, strength and uniformity.

Custom-Made

Every Revere Forging necessarily is custom-made to your design. Revere Technical Advisors work closely with you to obtain the information needed by our die-makers, and to see you obtain the full benefits of the forging process.

Quantities

Large orders are not necessary. Dies for small lots may be made as cheaply in many cases as patterns for castings, and naturally subsequent orders still further reduce the cost.

Write Revere. Just say, "Send someone to see me about forgings."

REVERE PRODUCES
NON-FERROUS FORGINGS IN:

COPPER • REGULAR BRASS
NAVAL BRASS • BRONZE
MANGANESE BRONZE
ALUMINUM SILICON
HERCULOY • NICKEL SILVER
ALUMINUM ALLOYS
MAGNESIUM ALLOYS

For: Plumbing Goods, Hardware, Pressure Fittings, Valves, Engine Parts, Electrical Equipment, Automotive Parts, Welding Nozzles, Contacts, Wing Nuts, Anchor-Bolts, Bushings, Refrigeration Equipment, Pump Parts, Housings, in general, Highly Stressed Parts.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Ave., New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in principal cities, distributors everywhere

Listen to Exploring the Unknown *on the Mutual Network every Sunday evening, 9 to 9:30 p.m., EDST*

OVER 3,000,000 Impressions from one TALIDE DIE

Talide
(TUNGSTEN CARBIDE)
Performance!

TALIDE DIE NIB WEIGHING 100 LBS.

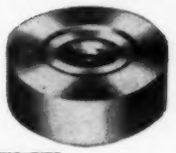
Here's a cold forming job on alloy steel forgings 4¼" dia. x 15⅜" long which requires more pressure and generates greater friction than steel dies can take in one operation.

By replacing steel with a Talide Tungsten Carbide Die, the projectiles were swaged in one operation. Two operations were needed with steel dies. After three million impressions, the smooth, highly finished, large Talide Die needed no redressing. And in each of the three million, the operators reported complete elimination of galling, scratching and pick-up.

Talide Dies can be used for any cold working operation where steel dies wear out too fast or on applications too severe for steel dies. Metal Carbides make Talide Dies in all sizes up to 24" diameter, I. D.

Complete information on TALIDE Tungsten Carbide Dies is given in Bulletin 43-WP . . . write for a copy.

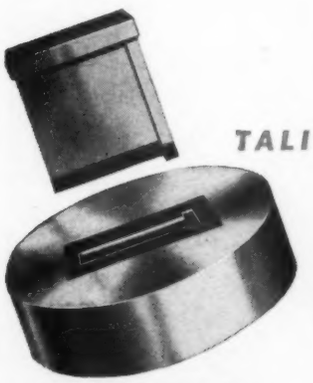
TUBE MANDREL



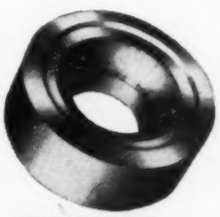
DRAWING DIES
(For Wire, Tubing and Bar Stock)

POWDER METALLURGY DIES
(For Compacting Powdered Metals and Materials)

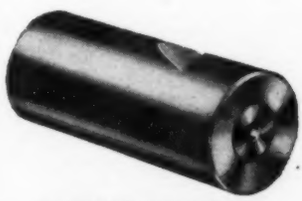
TALIDE METAL MEETS EVERY REQUIREMENT



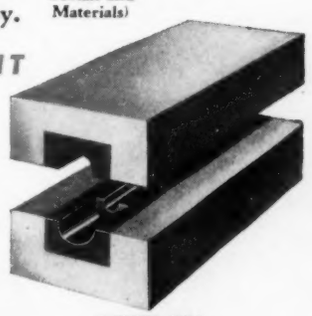
BLANKING AND FORMING DIE
(For Stamping Lamination Discs, Metals, Plastics, Paper)



SHEET METAL DIES
(For Deep Drawing Metal Products)



HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Rivets)



SWAGING DIES
(For Forming Solid and Tubular Shapes)

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

TALIDE

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

Plants are obtaining more production per man-hour with Niagara Power Squaring Shears because of accurate cutting, quick setting, ball bearing, self-measuring parallel back gages, full visibility of cutting line, instant acting Niagara sleeve clutch and other modern features.

Enclosed drive with gears, clutch and eccentrics running in oil assure long life and low maintenance cost. Four-edge, solid tool steel knives are standard equipment. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Detroit, Cleveland, New York.

Shear knives available for cutting alloy and special steels. Let us know what you desire to cut. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory regrinding service by the same skilled men who grind new Niagara knives.

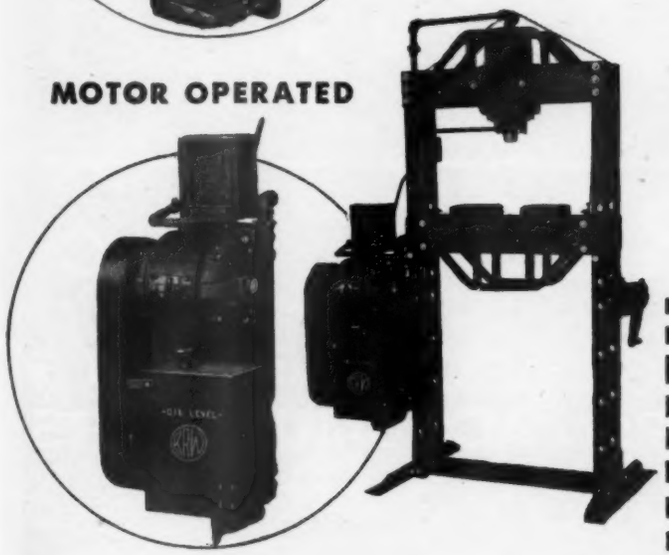
BUY UNITED STATES SAVINGS BONDS AND STAMPS

A PRESS TO MATCH EVERY JOB

HAND OPERATED

AIR-OIL OPERATED

MOTOR OPERATED



KRW HYDRAULIC ARBOR PRESSES CAN BE ENGINEERED TO YOUR PARTICULAR PRODUCTION PROBLEM

With prompt delivery assured

● The old conception of an arbor press is as different from the modern KRW Hydraulic Arbor Press as day is from night . . . now they are built in innumerable shapes and adaptations to work on literally hundreds of production jobs. They are available as speedy Hand Operated Presses; highly flexible Air Operated Presses or as versatile and effortless Motor Operated Presses. Then too, they are built in almost any conceivable physical form . . . tall, short, narrow, vertical or horizontal standing, as gap presses, forming brakes and many other designs. Mass production in a modern plant keeps KRW prices at rock bottom and quality at the highest possible peak. The new KRW illustrated 32-page Press Catalog is full of valuable information and suggestions on how others have saved time and money with some form of KRW Hydraulic Press. Mail the coupon for your copy now.

K. R. WILSON
BUFFALO 3, NEW YORK

SEND FOR *New* KRW HYDRAULIC PRESS BOOK

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Please mail me a copy of your New Hydraulic Arbor Press Catalog.

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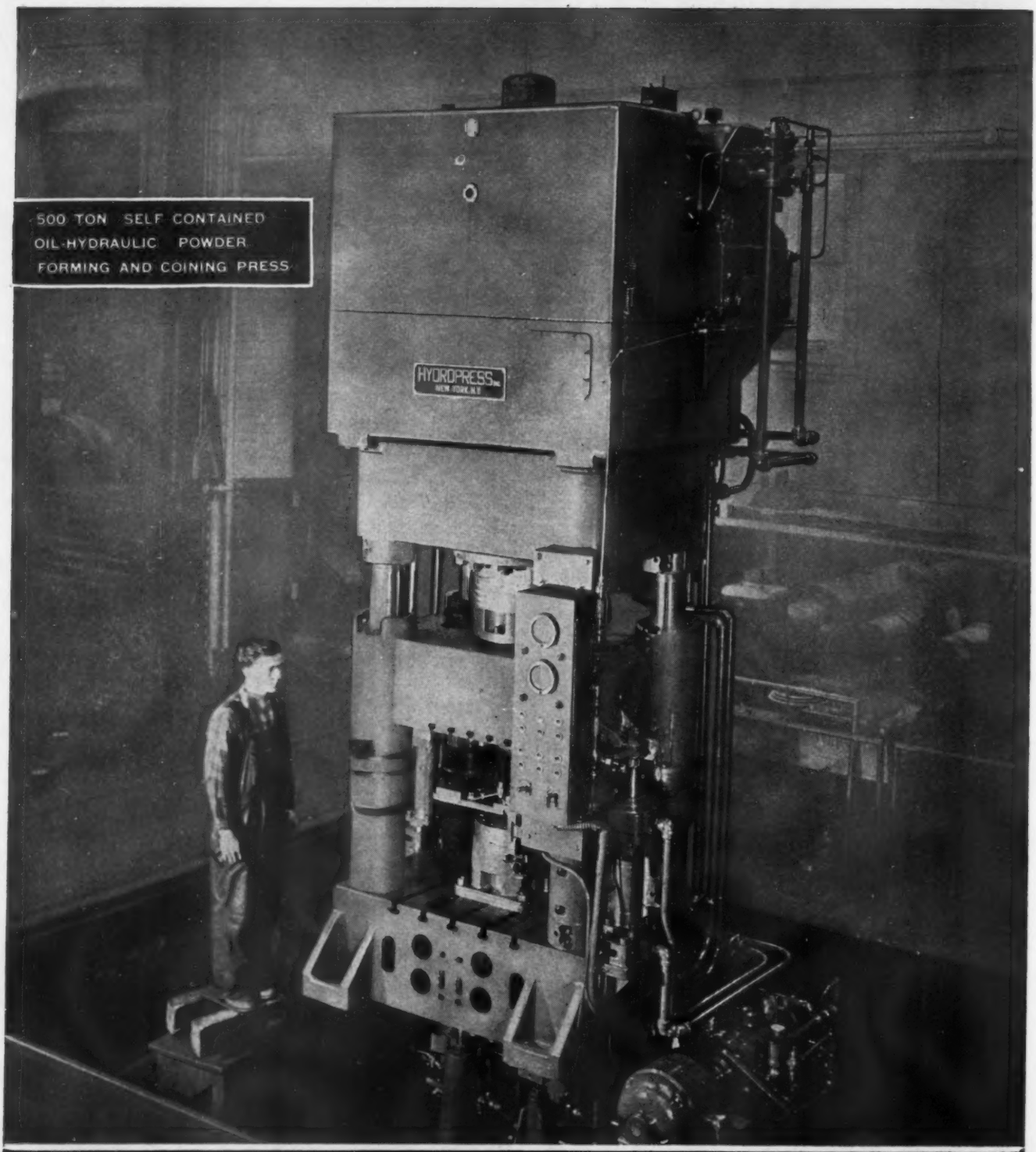
11



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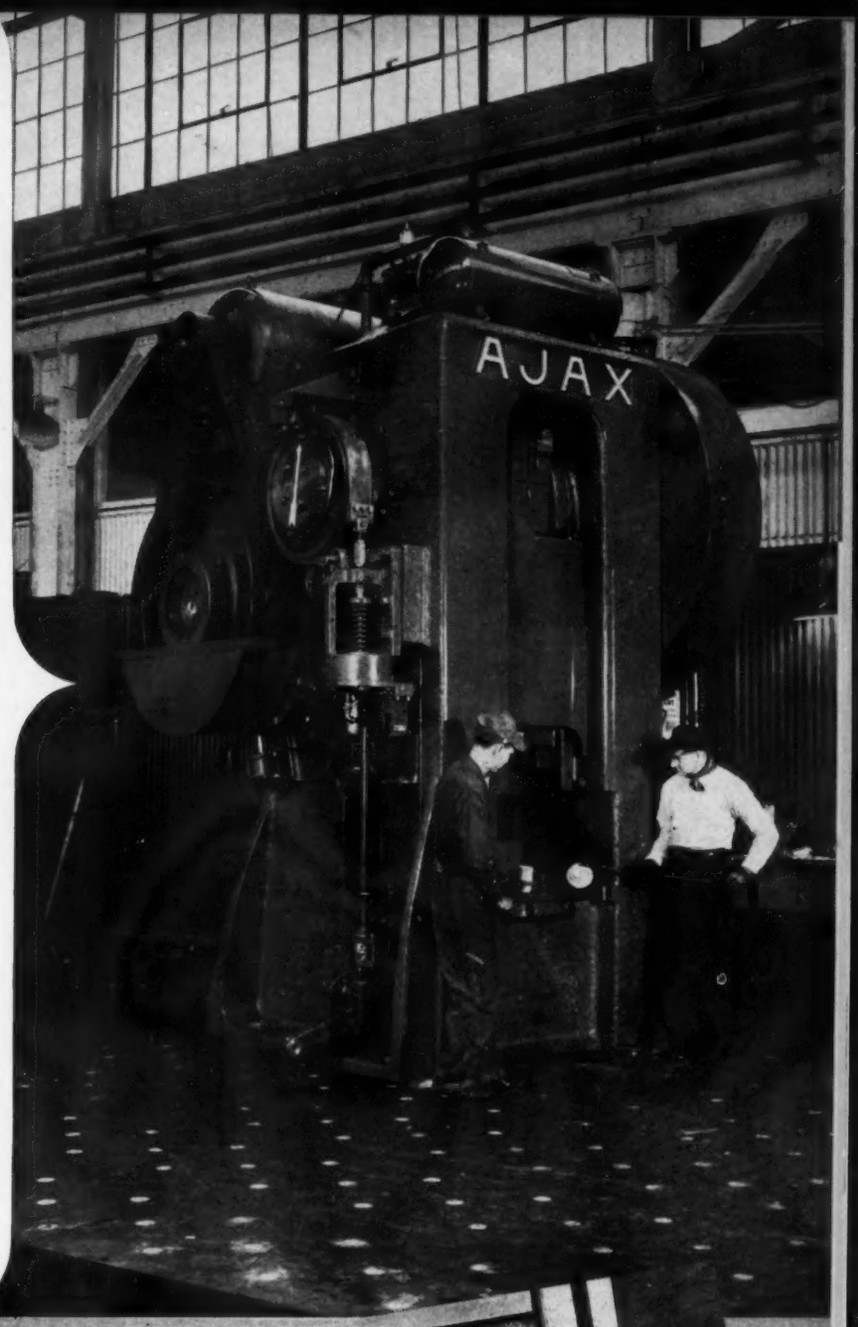
ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
STRETCHERS · PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE · NEW YORK · N Y

Automotive Forgings forged faster, better and at lower cost on

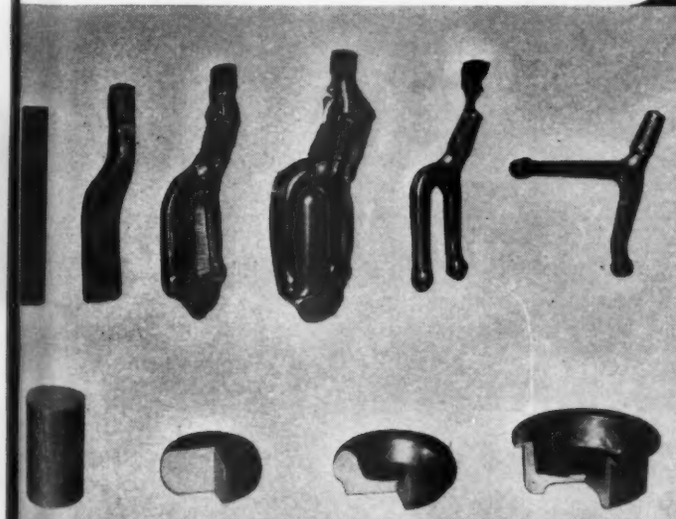
AJAX HIGH SPEED FORGING PRESSES

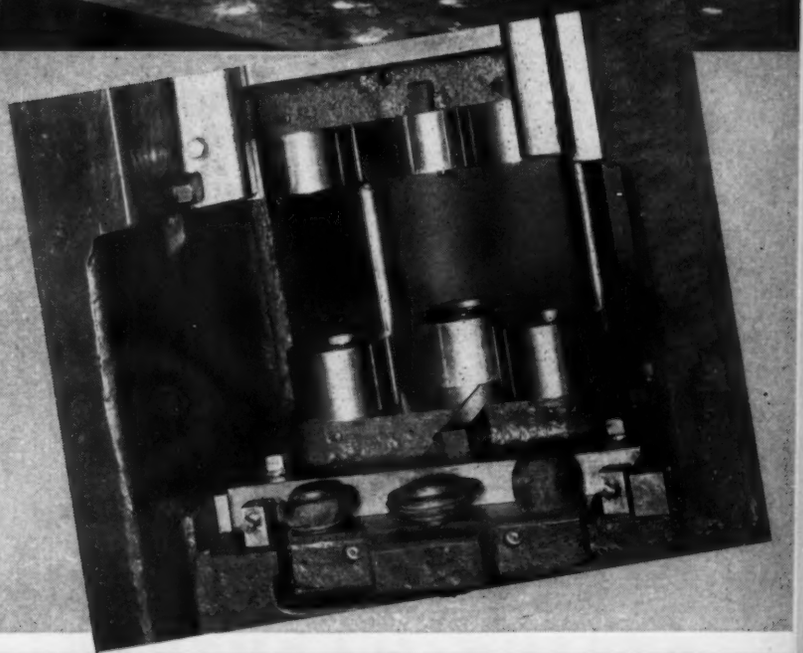


THE Ajax High Speed Forging Press has proved to be of exceptional advantage in the efficient production of a constantly widening range of forgings for the automotive industry.

Gear blanks, hub parts, knuckle support arms, connecting rods, differential ring gears, side gears, steering arms, bearing races and clutch pedals are but a few of the many parts which are being forged most profitably on Ajax Presses.

Write for Bulletin No. 75





THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
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DEWART BUILDING • NEW LONDON, CONN.

Request Catalog and Operating Data Showing how H&W Dieing Machines

SAVE 60% to 90% OF STAMPING COST

Conventional Presses

H & W Dieing Machine

STAMPING COST
60% to 90% SAVINGS

DIE SET-UPS
5 MACHINES AND OPERATORS
INSPECTIONS
HANDLINGS

DIE SET-UP
1 MACHINE AND OPERATOR
INSPECTION
HANDLING

DIE LIFE 600% to 1200% INCREASE IN USEFUL LIFE

Dieing Machines give an UNEQUALLED COMBINATION OF HIGH PRODUCTION AND HIGH PRECISION. Replacing 5 to 10 conventional presses, one Dieing Machine produces COMPLETE PER STROKE intricate stampings at speeds up to 600 s.p.m., holding product within .0002" limits when required. To substantial operating savings, is added thousands of dollars in die savings.

50-TON DIEING MACHINE

Other capacities:
10 tons to
300 tons

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THE HENRY & WRIGHT MFG. CO.
488 WINDSOR STREET HARTFORD 1, CONN.

HENRY & WRIGHT DIEING MACHINES

ETNA SWAGING MACHINES

Are Built Standard with Capacities Up to 6" Dia. Larger Sizes Up to 14" Dia. Are Built On Order.

Hydraulic Operated Tube Cutoff Mach.
Welded Tube Mills

ROTARY SWAGERS
HYDRAULIC FEEDS

The ETNA MACHINE Co.
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STRAIGHT SIDE SINGLE CRANK PRESSES
for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

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straight side press

ZEH & HAHNEMANN CO.
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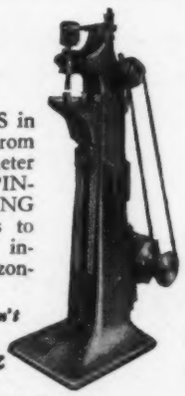
GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.



Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
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Prompt Service
on ALUMINUM CASTINGS made in PERMANENT MOLDS
exactly to your specifications
Ask us to quote on your requirements

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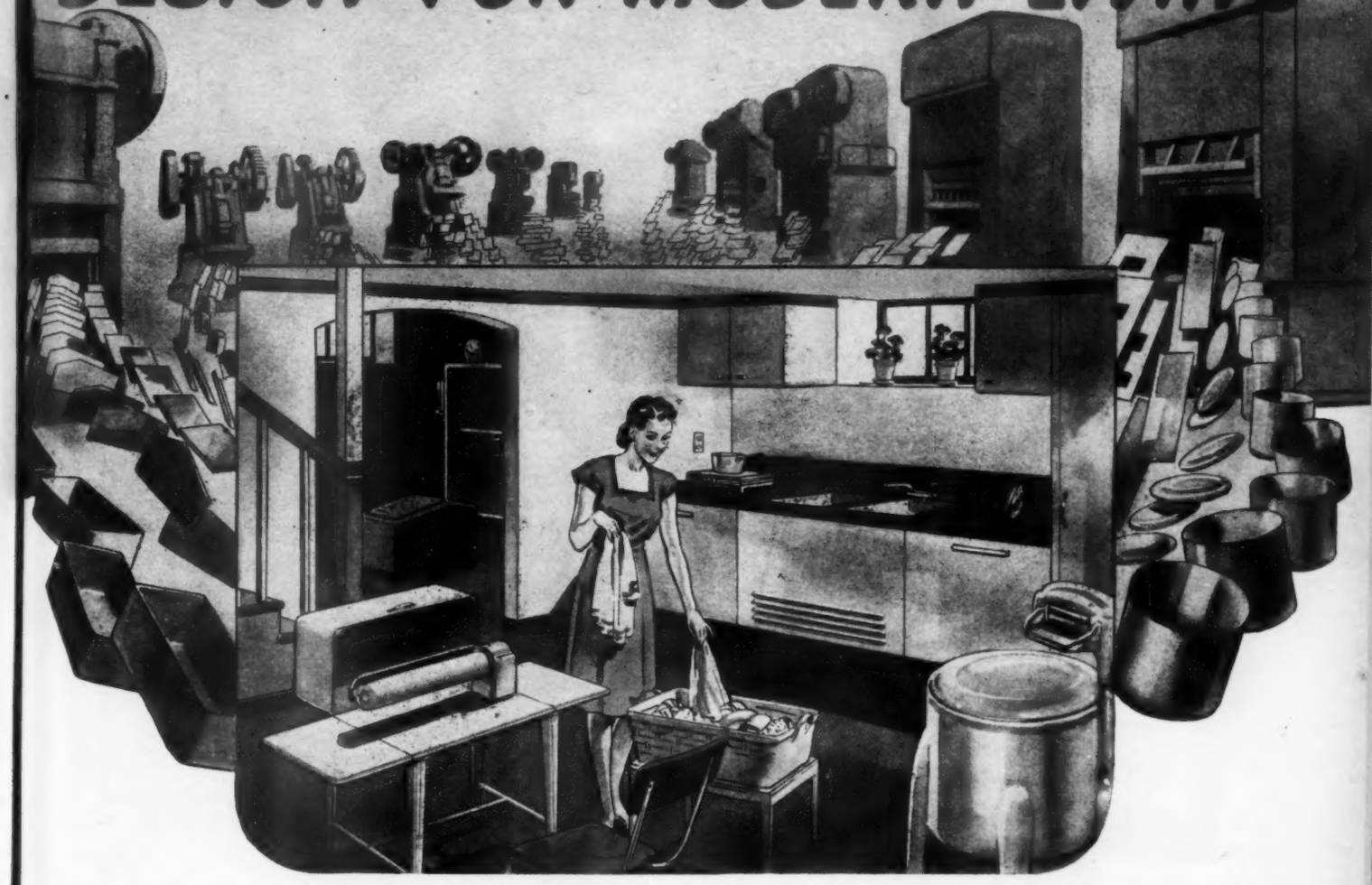
DESIGN FOR MODERN LIVING



in Press Production Today

Designed for press production, the stamped products reaching the American Home—the new washing machine, electric ironer, stoker and metal cabinets—create a new design for living. The once messy basement becomes a modern, pleasant workroom.

Wherever stamped products are being turned out, Danly Die Sets and Die Makers' Supplies guarantee precision, speed die making programs and cut "down time," because Danly means *known dependable accuracy.*

DANLY MACHINE SPECIALTIES, INC.
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DANLY *National Assembly*

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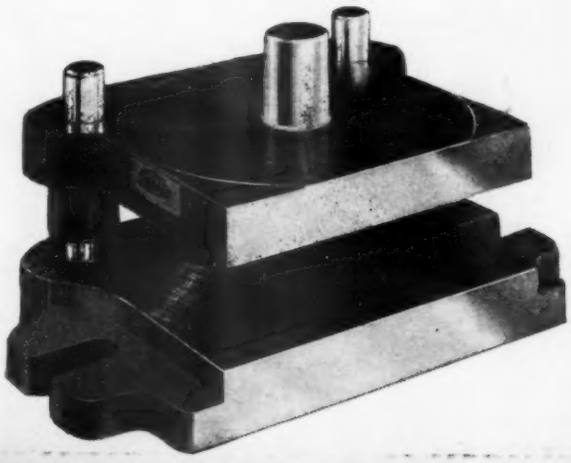
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles*



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USE HEADED AND THREADED FASTENERS FOR ECONOMY AND RELIABILITY

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Carbon Steel – Heat-treated Alloy Steels – Stainless Steel – Silicon Bronze – Brass – Bronze – Monel Metal.

Accurately made in standard dimensions or to your own specifications.

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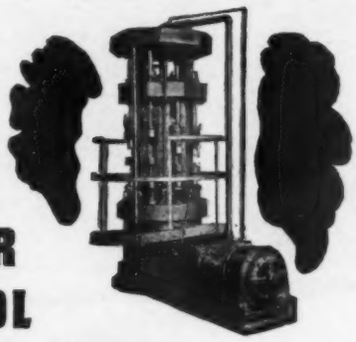
THE PLACE TO SOLVE YOUR BOLT PROBLEMS



OUR TOOL EFFICIENCY *is your* PRODUCTION EFFICIENCY

Efficient tool designing in post war competitive production is a "must". Our experience guarantees you tools—designed for economy of operation, resulting in your increased production at a lower cost.

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BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES

COLUMBUS DIE · TOOL and Machine Co.
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ESTABLISHED 1904

Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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AUTOMATIC EQUIPMENT
THE V&O Press Co.
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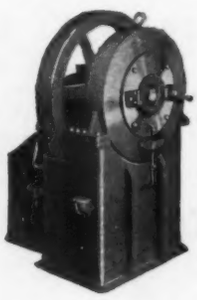
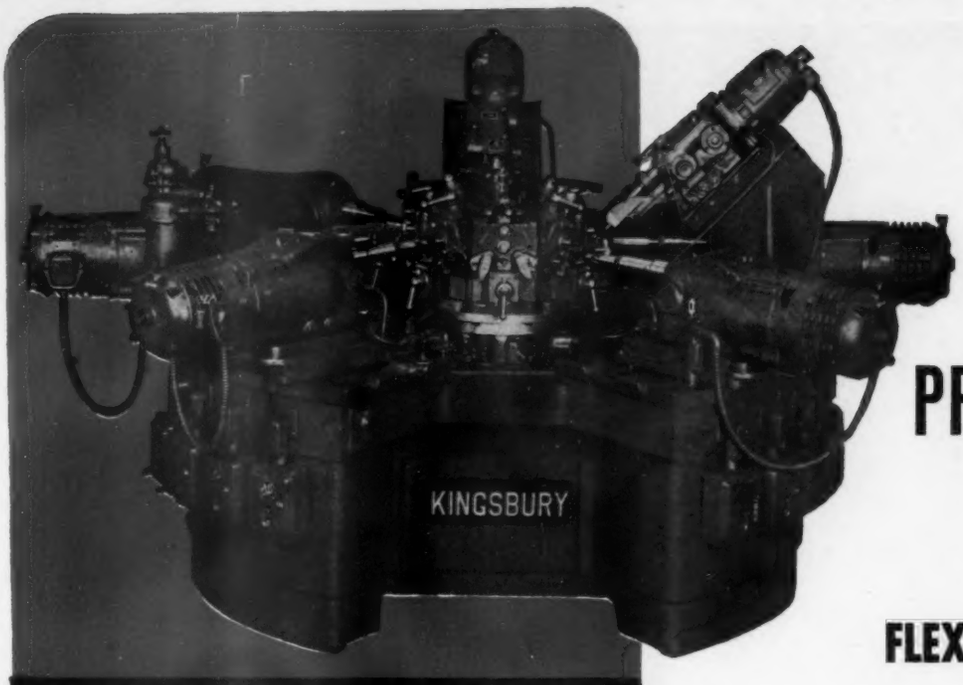


THE
TORRINGTON
ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.



HIGHER PRODUCTIVITY

through the FLEXIMATIC METHOD*

A KINGSBURY AUTOMATIC INDEXING FLEXIMATIC*

MAKES THE PART—A CAST IRON WORM GEAR BLANK

COMPLETING 7 MACHINING OPERATIONS

IN 14.2 SECONDS

Higher second operation production of cast iron worm gear blanks was the immediate result of the application of Kingsbury multiple machining methods. The *Kingsbury Fleximatic* illustrated consists of eight *standard* Kingsbury drilling heads mounted on a *standard* Kingsbury base equipped with an eight station automatic indexing turret. In a single chucking, all indicated drilling, reaming, and spotfacing operations are completed. A single operator loads rough blanks, trips the machine, and the cycle begins. While the cutting units are working, the operator removes a finished part and reloads the work holder at his station. *The cycle is completed in 14.2 seconds.*

Such multiple machining performance can be duplicated on many parts, yet, because *Kingsbury Fleximatics* are assembled from standard units, you have a special purpose machine at much lower cost. It will pay you to investigate the high production capacity and unusual flexibility of Kingsbury Fleximatics. Let our engineers study your production problems; it does not obligate you.

WE PUT OUR HEADS TOGETHER TO CUT YOUR DRILLING COSTS

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

Write for Bulletin F

*** KINGSBURY FLEXIMATIC**

—a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping heads on *standard* Kingsbury bases.

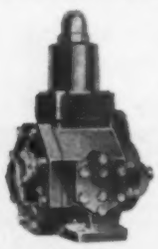
This operator pays his way

PHOTO COURTESY
LUKENS STEEL CO.
COATESVILLE, PA.

The higher cost of man-hours demands an increase in output of usable material. The price you pay — your actual total expense on metal cutting work is governed by two factors — the productivity of your equipment and the quality of the finished cuts.

Racine metal cutting Machines incorporate modern hydraulic feed and control. They cut faster because the blade is correctly applied by Racine's *exclusive progressive feed* throughout the cutting stroke. This scientifically correct feed also insures accurate cuts. No unnecessary turning or milling of excess stock in subsequent machining operations.

For nearly forty years, Racine engineers have specialized in metal cutting problems. Get the facts on the productive capacity of Racine Machines; available in all sizes from 6" x 6" to 20" x 20". Free catalog No. 12 includes a quick, easy to read description of all models. Write for it today. Also include a brief outline of your metal cutting work.



RACINE OIL HYDRAULIC PUMPS AND VALVES

Use Racine Variable Volume Pumps, Valves and Controls for smooth oil-cushioned power movements. Pump capacities to 30 G.P.M., pressure to 1000 lbs. p.s.i. Valves to 1½" I.P.S. Ask for catalog P-10-C.

RACINE TOOL AND MACHINE COMPANY, 1751 State Street, Racine, Wisconsin

STANDARD FOR QUALITY AND PRECISION • RACINE • RACINE TOOL and MACHINE CO. •

RACINE

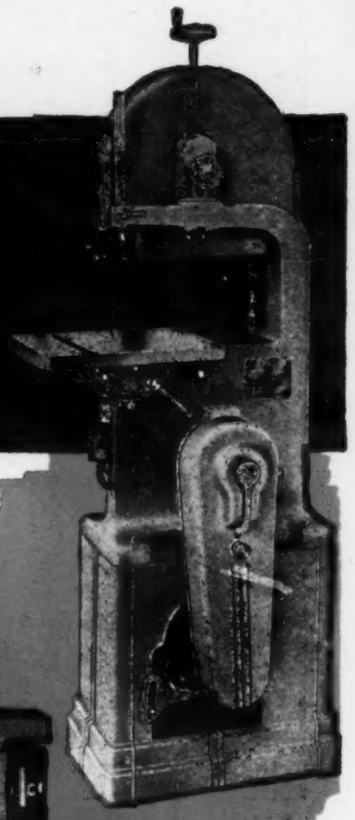
STANDARD FOR QUALITY AND PRECISION

KEEP YOUR PRODUCTION "LIGHT ON ITS FEET"!

Speed Up Tooling Shifts With

Walker-Turner

MACHINE TOOLS



Walker-Turner Light Machine Tools reduce your re-tooling problems to a minimum. Here's why:

(1) Quickly shifted from one operation to another.

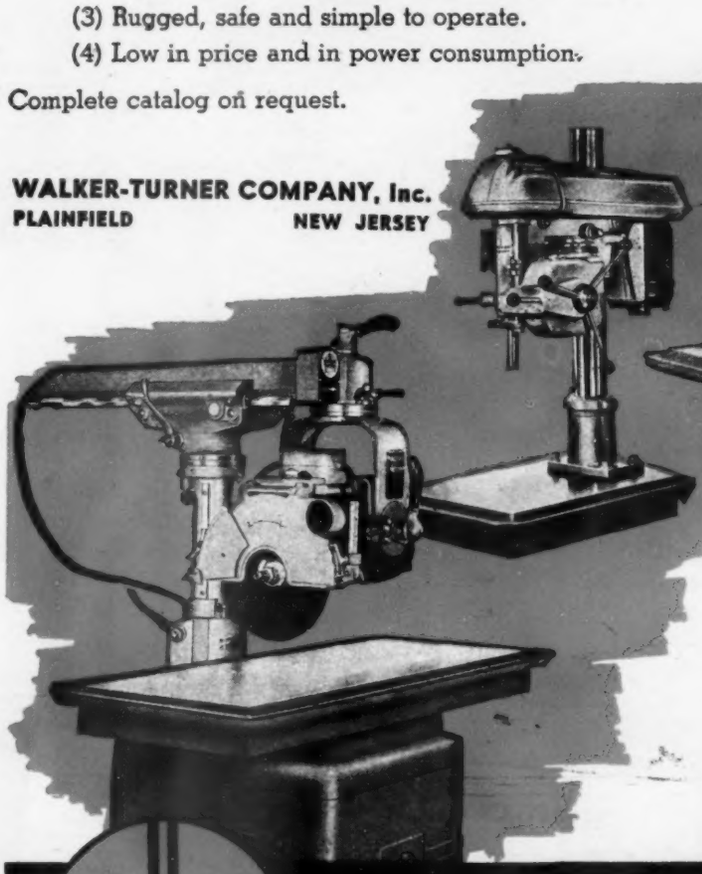
(2) Ideal for special tooling set-ups—precluding need for high-priced special machines of limited usage.

(3) Rugged, safe and simple to operate.

(4) Low in price and in power consumption.

Complete catalog on request.

WALKER-TURNER COMPANY, Inc.
PLAINFIELD **NEW JERSEY**



METAL CUT-OFF MACHINE

Universal head travels 21½" on gliding ram; patented, geared motor gets shaft closer to work, smaller blades.

20-INCH DRILL PRESS

Spindle speeds 260-5200 r.p.m.; capacity, ¾" in steel, 1" in cast iron.

14" BAND SAW

Back-gearing and cone pulley gives high speeds for wood (up to 4630 s.f.m.), low speeds for metals (as low as 60 s.f.m.). Also made in 16" model.

RADIAL DRILL

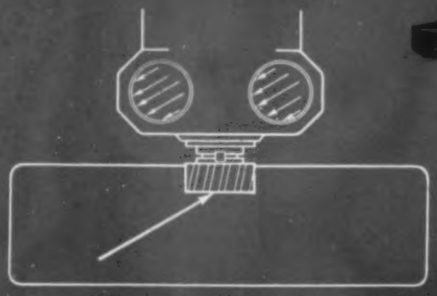
Spindle speeds, 160-8300 r.p.m.; drills to center of 62" circle.

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

No. 1-14 Milling Machine—Table, 52" x 9"—Table travel, 14"



● With *exclusive mounting between two posts*—Kent-Owens Milling Machines are unusually rigid and accurate in operation! The head is mounted on two cylindrical ground steel posts which carry the spindle midway between them...assuring balanced load in either direction. There is no overhang and no cocking action. This is one of many advanced features of Kent-Owens design—helping to speed up production with simple, efficient, practical milling. Write for latest bulletins. Kent-Owens Machine Company, Toledo, Ohio.

Specify

KENT-OWENS

Milling Machines

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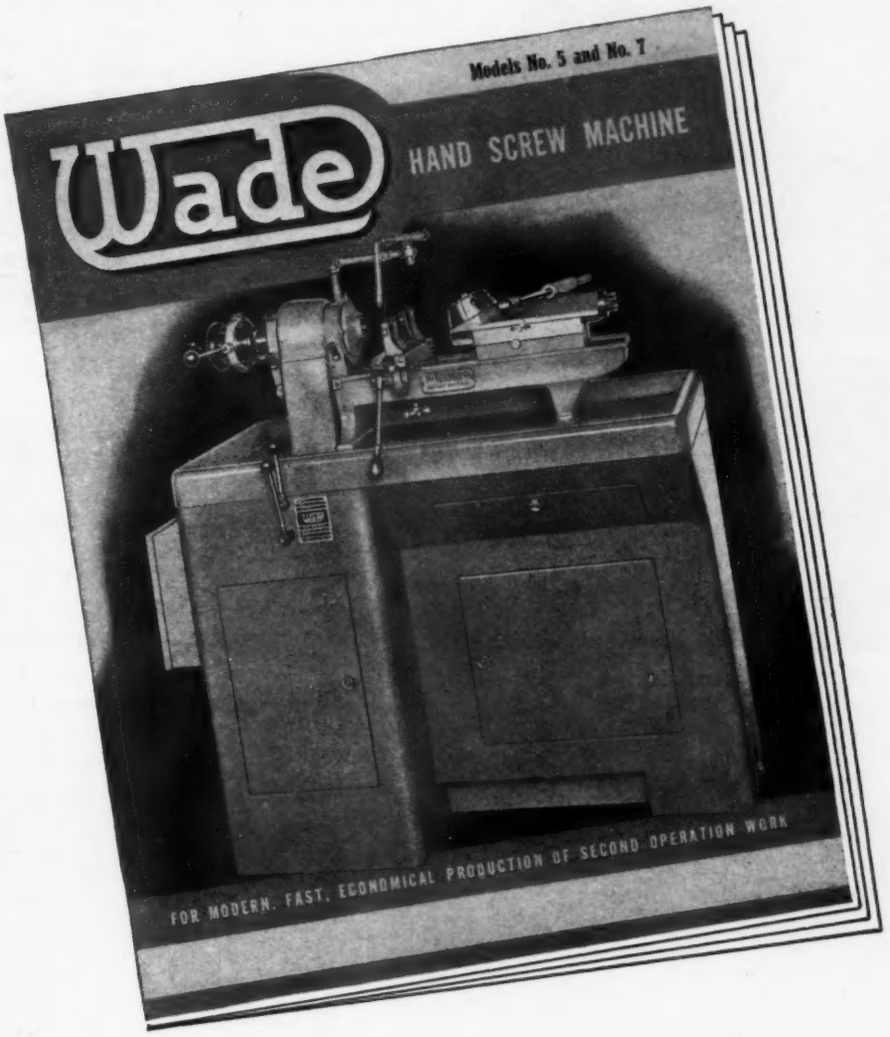
NEW CATALOG

Here is a catalog bright and new
Compiled by us to present to you



It's a key to higher profit
And it's free—just write us for it.

Wade

The Wade Tool Co.
52 RIVER ST.
WALTHAM 54, MASS.

Please send me the new Wade Hand Screw Machine Catalog No. 53

NAME _____ TITLE _____

COMPANY _____

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CITY _____ STATE _____

Hartford Super-Spacer, equipped with face plate, provides precise location of work on a jig borer.

THIS TRIED *and* PROVED INDEXING DEVICE OFFERS WIDE VERSATILITY

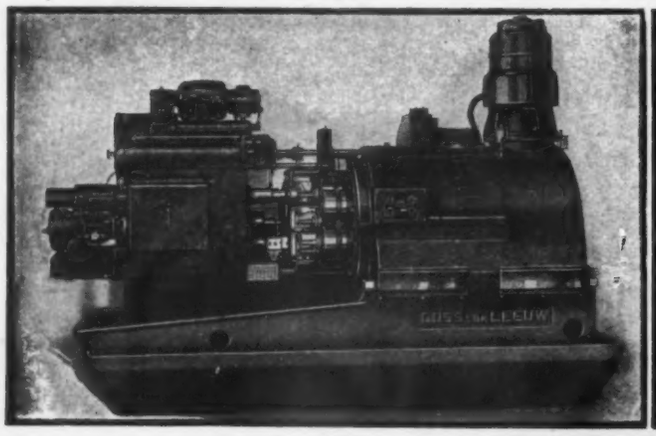
The typical job shown here . . . indexing on a jig boring operation . . . illustrates the versatility of the Super-Spacer and its outstanding accuracy on this class of work. It is equally versatile on production runs and can be depended on to maintain accuracy because of its rugged construction.

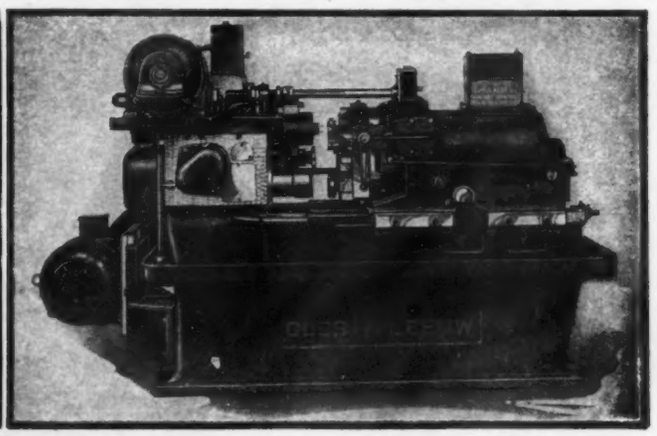
The wide use of the Hartford Super-Spacer for indexing operations on drilling, milling, grinding and slotting are also indicative of its ability to meet and solve a wide range of problems, which in turn accounts for its universal acceptance in modern shops.

Write for further details of the Hartford Super-Spacer and how it is being used to save time and assure highest precision in indexing.

The HARTFORD SUPER-SPACER

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD 5, CONN.





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

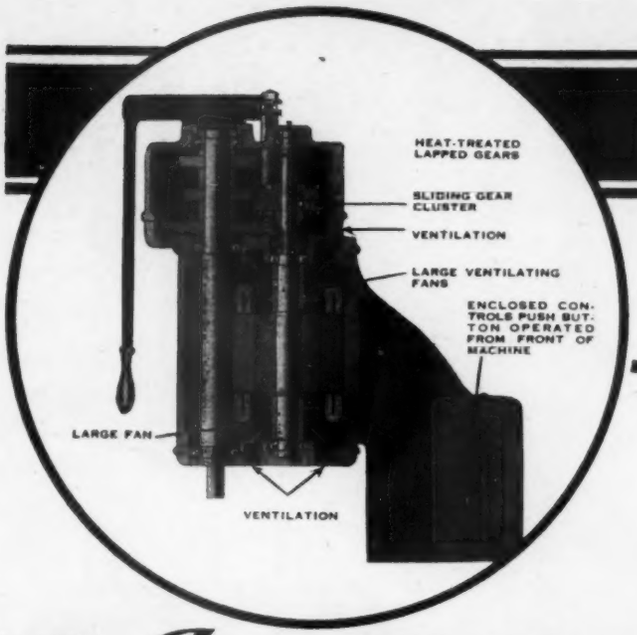
4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.



Avey FEATURE No. 2

THE Avey TYPE MA-6

AVEY-MATIC POWER FED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

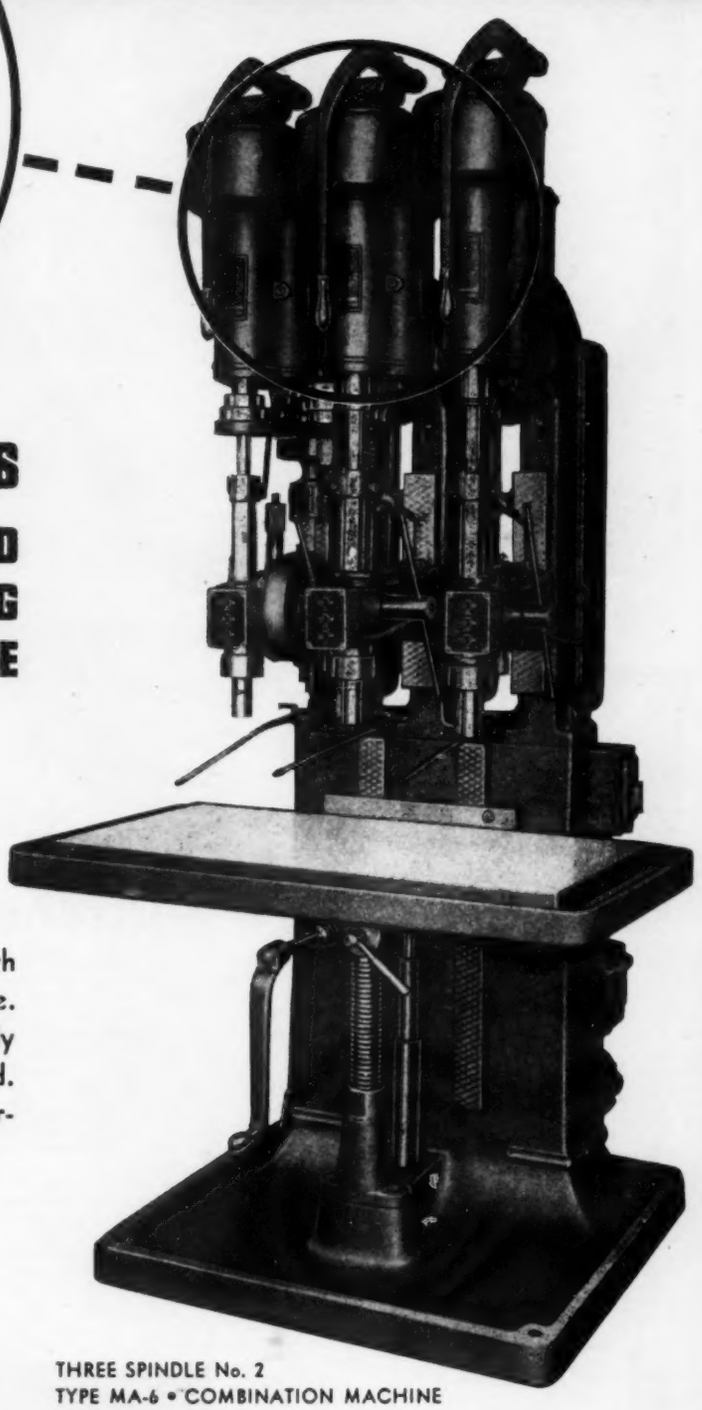
features

motor and gear box construction of six speed machine

Motor mounted directly back of spindle with gearing between motor and spindle drive sleeve. Two speed motor, three speed transmission. Only one pair of gears in mesh at any spindle speed. Motor and spindle drive mounted on ball bearings, fan ventilated motor.

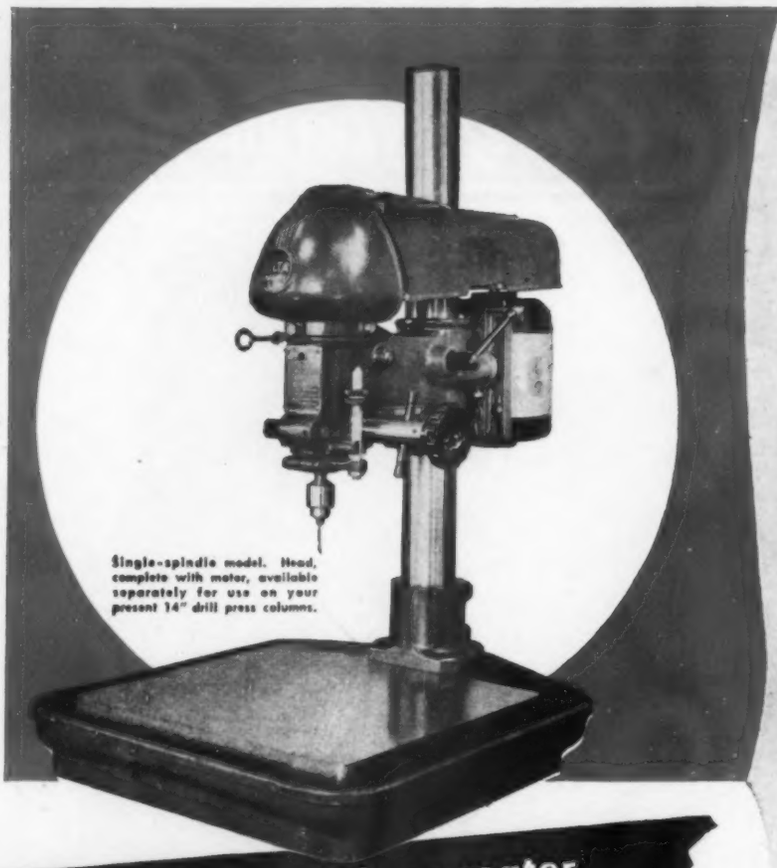
Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.

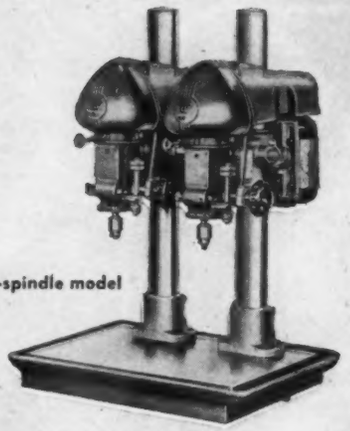


THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

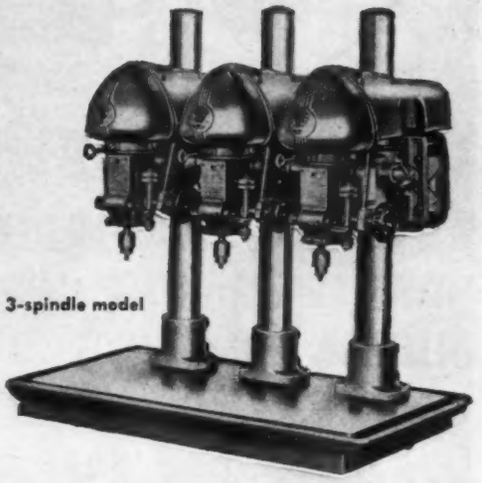
Avey DRILLING MACHINES



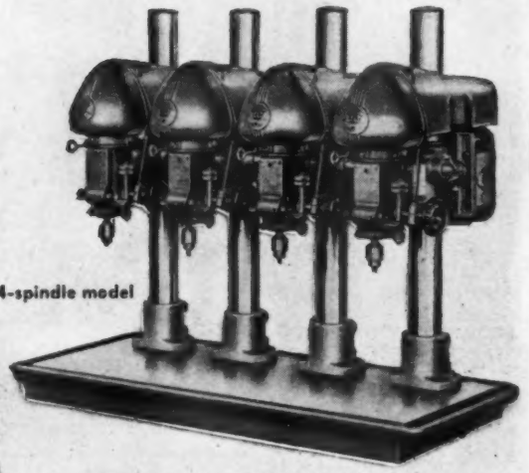
Single-spindle model. Head, complete with motor, available separately for use on your present 14" drill press columns.



2-spindle model



3-spindle model



4-spindle model

A low-cost tool for greater accuracy on sensitive drilling from .025" to 1/4" diameter...

Delta-Milwaukee Super-Hi-Speed Drill Press

Embodies all the well-known construction features and operating advantages of other Delta-Milwaukee drill presses

Now — a high-speed drill press by Delta-Milwaukee, for greater precision on small-hole drilling of plastics, aluminum, and other metals. Drills to the center of a 14" circle.

Famous Delta-Milwaukee features include: Lubricated-for-life ball bearings, double-sealed against harmful abrasive dust . . . Preloaded ball bearings . . . Precision-ground spindles . . . Dynamically-balanced pulleys . . . Dynamically-balanced motor . . . Specially-selected Jacobs chuck.

Single-spindle model, with production table. 2-spindle, 3-spindle, and 4-spindle models, with sectional tables. Head, complete with motor, available separately for special set-ups. Three-step pulley permits spindle speed range of 12,000 . . . 8000 . . . 5000 R.P.M. Full spindle travel is 2¼".

See your nearby Delta industrial distributor for the complete story on the new Delta Super-Hi-Speed Drill Press.

Send for free catalog that pictures and describes the entire line of compact, portable, low-cost Delta-Milwaukee Machine Tools. Use coupon below.

DELTA MILWAUKEE
REG. U.S. PAT. OFF.

M-17

[Tear out coupon and mail today]

THE DELTA MANUFACTURING CO.
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Please send me free copy of catalog on low-cost Delta-Milwaukee Machine Tools.

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Company_____

Address_____

City_____ (_____) State_____

Abrasive Finishing Machines

Grinders

Band Saws

Cut-Off Machines

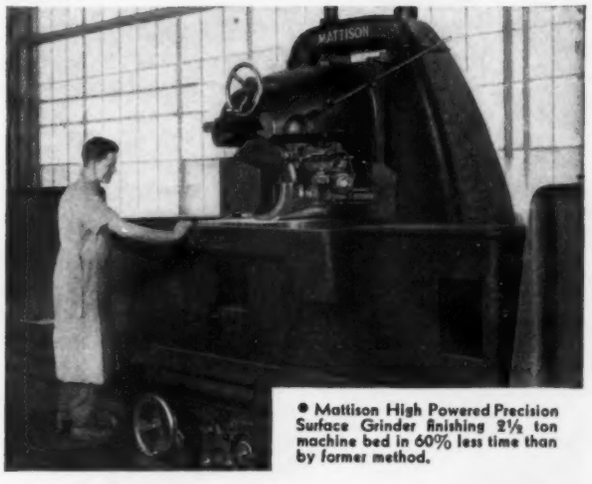
PRECISION SURFACE GRINDING ON A *Big Scale*

Mattison Surface Grinders are providing a fast, economical and exceedingly accurate method for finishing parts weighing up to several tons in weight.

The High-Power and rigidity in construction of the Mattison Grinder, combine with accuracy and speed of operation to permit handling jobs like those shown, at a great saving of time.

● V-shaped and flat ways of lathe bed being ground on a Mattison Grinder. A practical and time-saving method for grinding to utmost accuracy and smooth finish.

● Five ton lathe bed with hardened steel ways. Ways and heads of hold down bolts ground complete in one setting. Time is saved; a more accurate job is obtained.

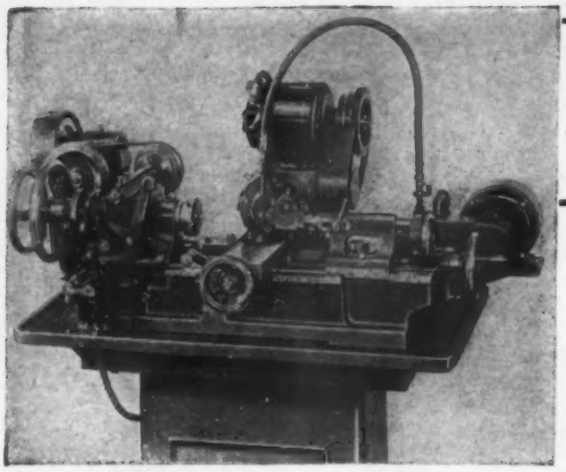


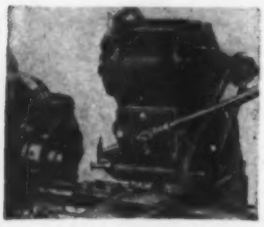
● Mattison High Powered Precision Surface Grinder finishing 2½ ton machine bed in 60% less time than by former method.

Write for Free Set-up Book containing further examples, showing how others have reduced time and cut costs with Mattison Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS





(Left)—Waltham Thread Miller equipped with Internal Threading Attachment.

•

(Below)—Waltham Thread Miller equipped with Relieving Head.

WALTHAM THREAD MILLERS

provide versatility and precision in small thread production

Designed especially for small work calling for close tolerances, WALTHAM THREAD MILLERS can be depended on to meet the most exacting specifications for precision parts.

An outstanding feature of these improved machines is the use of three motors, one each for driving cutter, work and pump. Machines can be arranged with speeds suitable for brass or steel or both. Motors are wired so that a single start and stop station will control all at one time.

Standard equipment includes three motors with control, follow rest, milling cutter, indexing device, 5 pitch lead screw and change gears for cutting from 5 to 40 threads per inch.

A wide range of special equipment is available and greatly enlarges the usefulness of this machine. Full details on request. Write for Bulletin 244A.

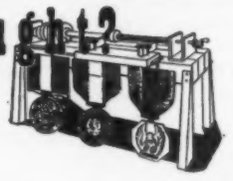
CONDENSED SPECIFICATIONS

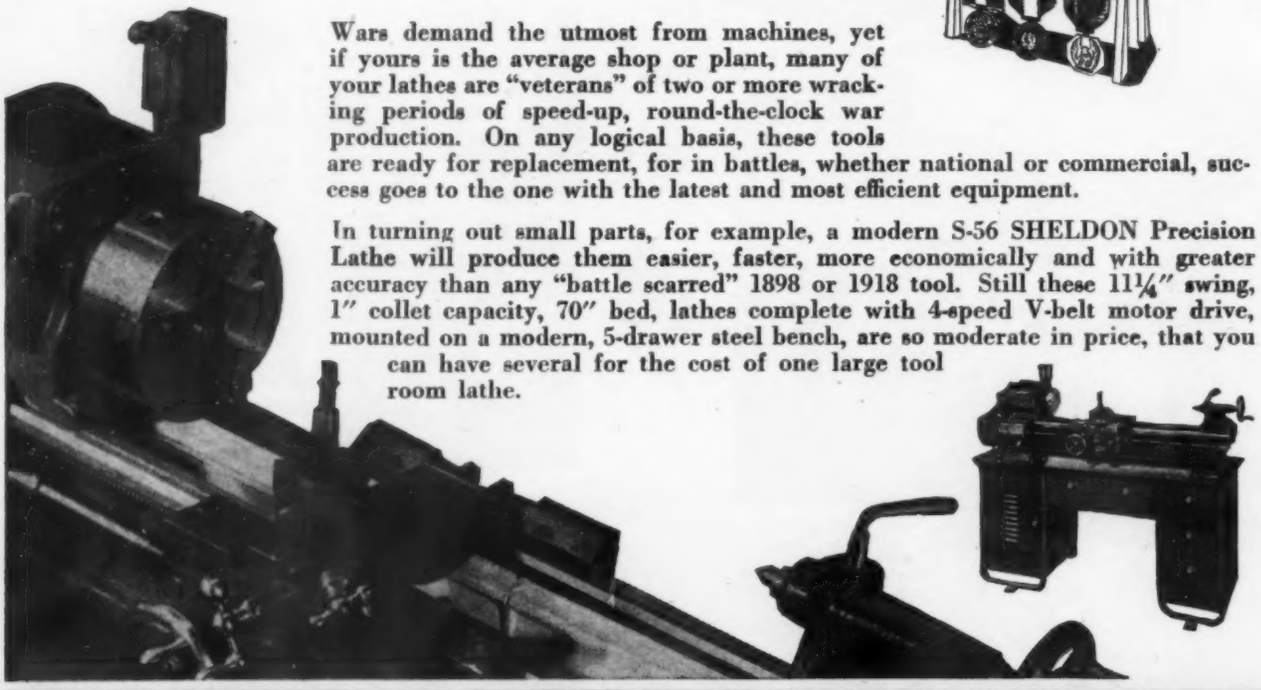
Swing over carriage—3"
Dia. work handled—2" or smaller
Thread length (work held on centers)—8¼"
Thread length (work held in chuck)—10"
Max. Dist. between centers—12"
Floor Space—48"x34"
Net Weight—850 lbs.

WALTHAM
TRADE MARK REGISTERED U.S. PAT. OFF.

WALTHAM
MACHINE WORKS,
WALTHAM, MASS.

How many Wars have your lathes fought?





Wars demand the utmost from machines, yet if yours is the average shop or plant, many of your lathes are "veterans" of two or more wracking periods of speed-up, round-the-clock war production. On any logical basis, these tools are ready for replacement, for in battles, whether national or commercial, success goes to the one with the latest and most efficient equipment.

In turning out small parts, for example, a modern S-56 SHELDON Precision Lathe will produce them easier, faster, more economically and with greater accuracy than any "battle scarred" 1898 or 1918 tool. Still these 11¼" swing, 1" collet capacity, 70" bed, lathes complete with 4-speed V-belt motor drive, mounted on a modern, 5-drawer steel bench, are so moderate in price, that you can have several for the cost of one large tool room lathe.

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers
4234 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U.S.A.

Why does this TAP come in a CAPSULE?

Because only the best package is good enough for *Threadwell* High Speed, Ground Thread Taps.

If you could see the care and craftsmanship that goes into the grinding, finishing, hardening (including Threadwell's exclusive COLD-TEMPER process at 120° below zero), testing and inspection of these precision taps

- you'd understand why we put them in the Tap-Capsule — for complete, individual protection against dirt or careless handling, and for easy selection *before* unwrapping.
- you'd appreciate why we've left no stone unturned to improve the convenience and utility of these fine cutting tools — why we treat them with a special *greaseless rust-proofing* that keeps them always clean, dry and shining, ready for instant service
- why they're the only taps that are "i-dot-ified", *red* dot on the shank for cut thread, *white* for commercial ground, *blue* for precision ground
- you'd realize why we spare no pains to provide the finest possible service on Threadwell Taps — *personal attention* service at the factory and through carefully selected distributors who know how to meet your individual taps requirements.

All Threadwell Taps and Tools are sold exclusively thru Mill Supply Distributors. Ask for Threadwell Tap-Capsuled Taps.

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT AMERICA

Export Distributors

Canada — Bridge Machinery Company, Montreal

England — Skylux, Ltd., London

Brazil — Alfredo Kramer & Cia. Ltda., Rio de Janeiro, Sao Paulo

Mexico — W. Picard, Mexico, D. F.

John H. Graham & Co., Inc. of New York City

THROUGHOUT THE REST OF THE WORLD

Threadwell

SINCE 1902

"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

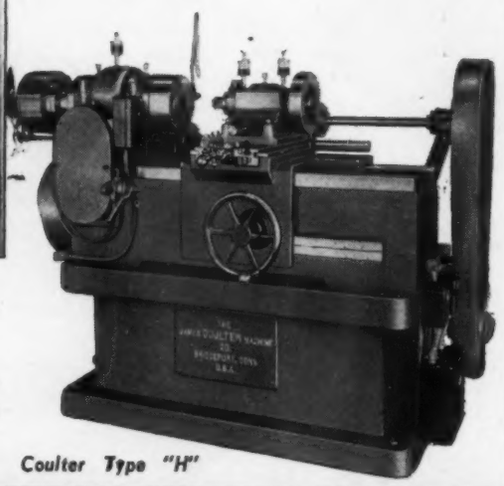
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

SAVING MINUTES

WHEN MINUTES COUNT WITH A **COULTER** HOB THREAD **MILLER**

ILLUSTRATED LITERATURE AVAILABLE

ACCURATE HOB THREADING is done with Precision and Speed on this RIGID . . . SIMPLE . . . FULLY MOTORIZED COULTER MACHINE.



Coulter Type "H"

It has unlimited capabilities, with a maximum external thread of 7 inches; either for right or left hand threads, internal or external.

Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chucks, or special face plate fixtures can be threaded on this COULTER TYPE "H".

The James COULTER Machine Co.

BRIDGEPORT • CONNECTICUT • U.S.A.

New! **REED** *Cylindrical-Die* **THREAD ROLLER**

MODEL A22

The ROLLED THREAD DIE CO. announces the new Model A22 REED Cylindrical-Die THREAD ROLLER . . . worthy successor to the Model 21 which has for several years demonstrated the advantages of *Reed-pioneered triple-die rolling.*

The unusual range and flexibility of the A-22 provide for low production and inspection costs on a large variety of hollow parts, short threads on top-heavy parts, tapered threads, threads close to shoulders, and other difficult parts made of materials ranging from soft non-ferrous metals to semi-hard alloy steels.

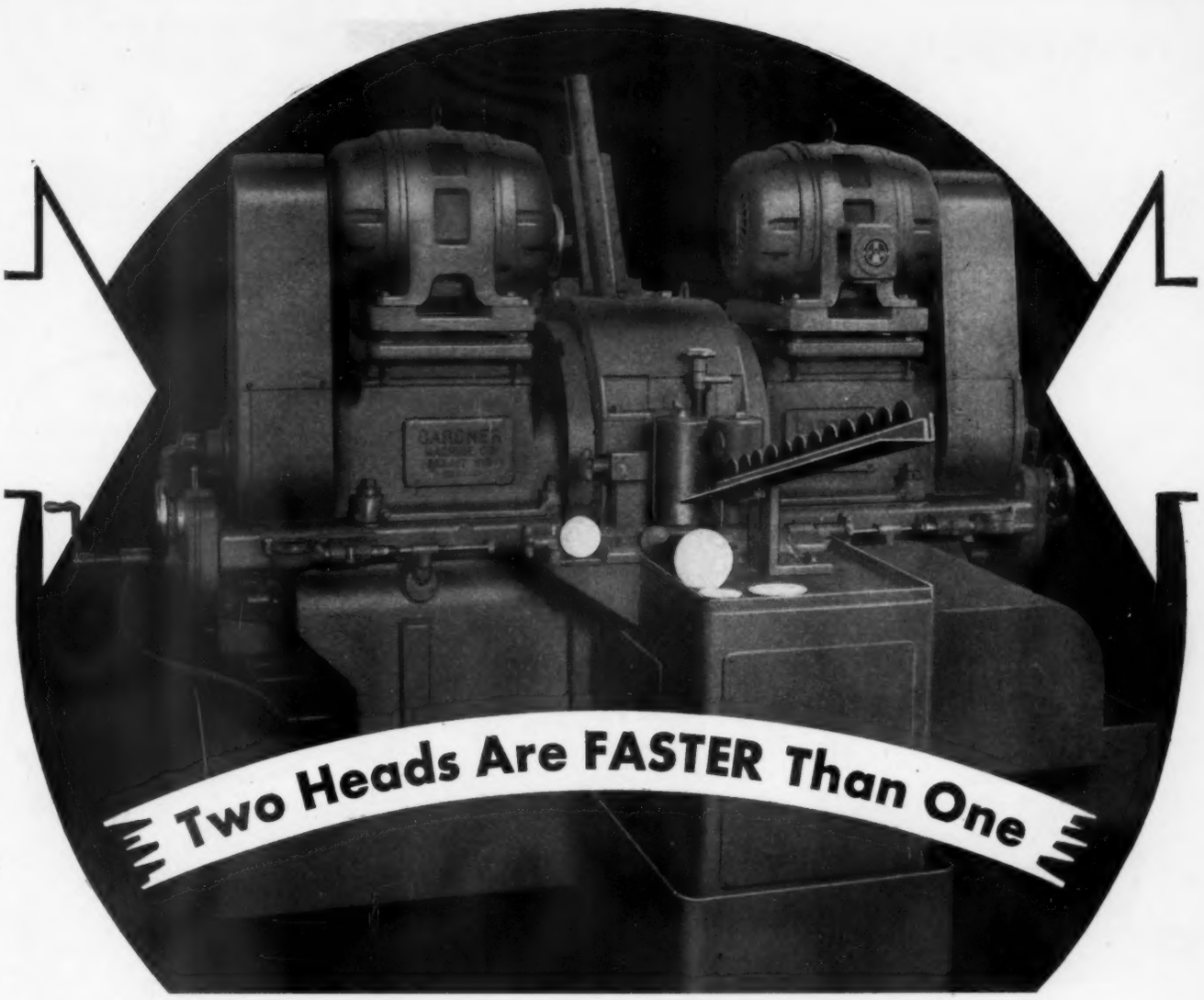
Write for Bulletin A22-1 which contains complete specifications.

For **PRECISION** *Threading - Knurling - Forming - Burnishing - Serrating*

ROLLED THREAD DIE CO.

Thread Rolling Dies and Machines

237 Chandler St., Worcester 2, Mass.



HERE is another example of how GARDNER Double-Grinding is helping make possible the *high production* schedules that are necessary to meet present-day competition. As compared to the ordinary Surface Grinder, which employs *one* head and grinds *one* surface at a time, these modern Gardner Grinders carry *two* opposed wheels and grind parallel surfaces *simultaneously*.

The No. 125-23" GARDNER Double-Head GRINDER, shown above, grinds both parallel faces of hard rubber meter valve discs to close tolerances in one operation. A "push-through" type fixture and rubber roll feeder carry the discs between opposed abrasive wheels in a rapidly moving continuous stream.

PRODUCTION: 20 to 30 pieces per minute, on a valve disc 3¾" diameter x .185" thick; removing .010" stock over all.

TOLERANCES: .0005" for parallelism and .001" for uniformity.

Give a Thought to GARDNER-GRINDING in Your Modernization Plans!

Write for GARDNER Double-Grinding Bulletins!

GARDNER - GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

ABRASIVE No. M-34

VERTICAL SPINDLE GRINDER

SPECIFICATIONS

WORK CAPACITY:
24" long
8" wide
12" high

SPINDLE:
Built-in 5 hp motor, 3450 R.P.M.
ball and roller bearing

WHEEL SIZE:
Segment type, 6" diam.

TABLE SIZE OVERALL:
59" x 10½"

NET WEIGHT:
3000 lbs.

Write for Bulletin.

We will gladly supply information on Abrasive machines on the U. S. Government Surplus Tool List... just send us the machine serial numbers. We will endeavor to provide attachments, accessories and repair parts as required.

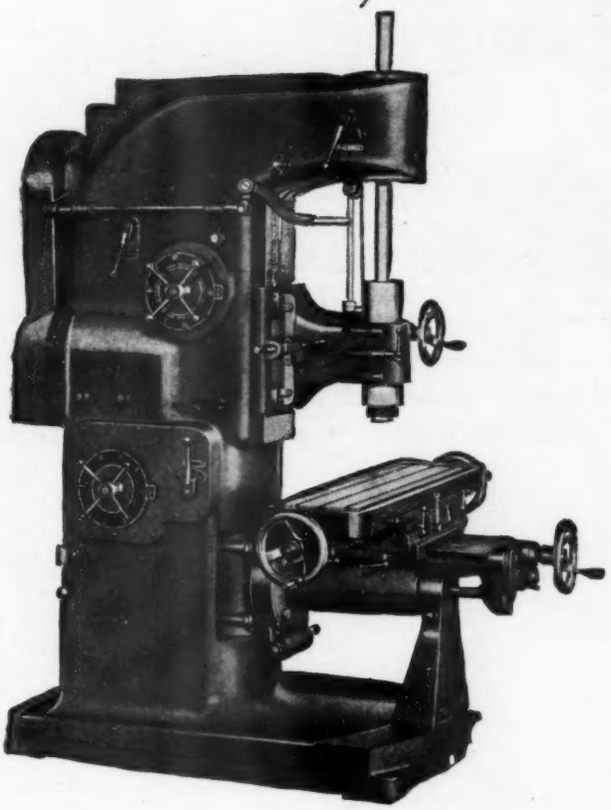
SEE OUR CATALOG IN SWEET'S FILE

ABRASIVE MACHINE TOOL COMPANY EAST PROVIDENCE 14, RHODE ISLAND · DEALERS IN PRINCIPAL CITIES

KEEP PRODUCTION UP...

KEEP COSTS DOWN

with KNIGHT MILLERS



By producing on a single miller, through ordinary methods, jobs that often require two or more machines, Knight Millers are proving every day their unusual value as a time-saving, profit-building investment in hundreds of plants, shops and toolrooms everywhere.

Eliminating special set-ups and the transfer of complicated milling, boring or shaping jobs from one machine to another, ups production and saves operator's time. Knight's tilting, swiveling table makes costly jigs and fixtures unnecessary for out-of-the-ordinary work and greatly increases working area. Wide variation in spindle feeds and speeds provide for the use of many various size cutters.

These features, combined with Knight's acknowledged advantages of speed, precision, accuracy, ruggedness, smooth operating simplicity and convenience mean faster, more efficient operation, uncommon economy in productive hours and a minimum of equipment expense.

How you can keep production up and costs down are all explained in Knight's Catalog which you may have for the asking.

Write for YOUR Copy Today!

W. B. KNIGHT

MACHINERY COMPANY

KNIGHT VERSATILE MILLERS ACCURATE-RIGID

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor. 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal. 1½" capacity
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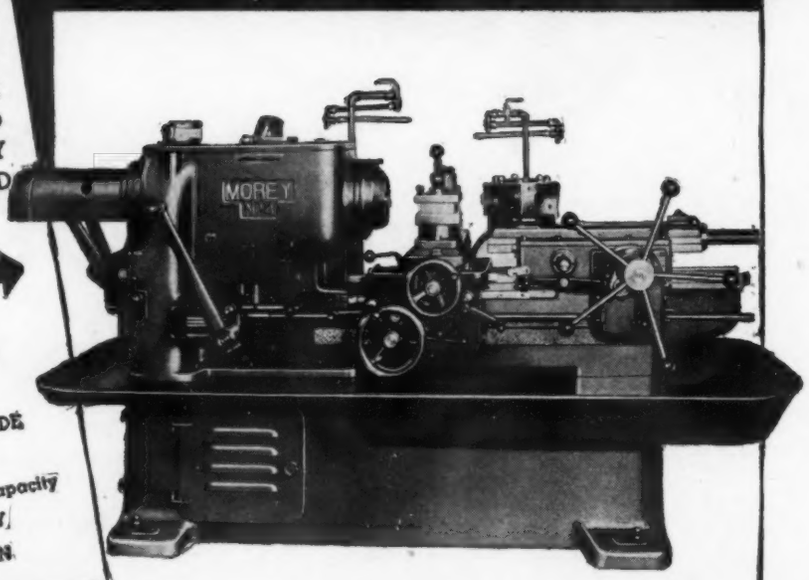

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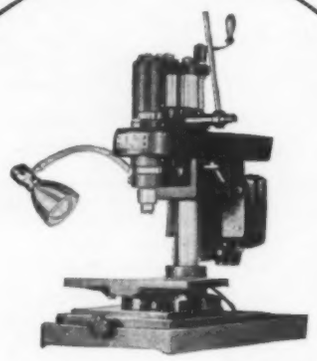

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Specify Hamilton "Maxi-Jr.-E" Super Sensitive
DRILLING MACHINES

A "small hole" **production** drill supplying sensitive accuracy far beyond the usual requirements. Built for the finest precision work. (Drilling capacity .004" to 5/16" in all drillable material.) Built for intense production usage. "Takes" abuse . . . and maintains accuracy. Write for literature and prices. Address Department D-J.

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SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS
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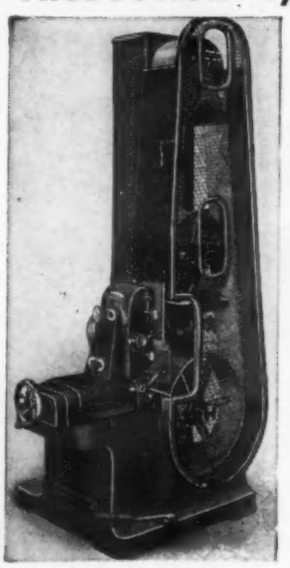
. . . for a mechanical finish far superior to that obtained by hand — use the "PRODUCTION" Type A HIGH SPEED POLISHING MACHINE



and holding devices, together giving full details.

Cylindrical work can be fed automatically by means of a power feed through this machine. The Type A represents the highest development of polishing and finishing metals, fibre, rubber, wood, etc. Automatic feeding and holding devices, together with the abrasive belt, assure a mechanical finish far superior to anything yet obtained with hand operations.

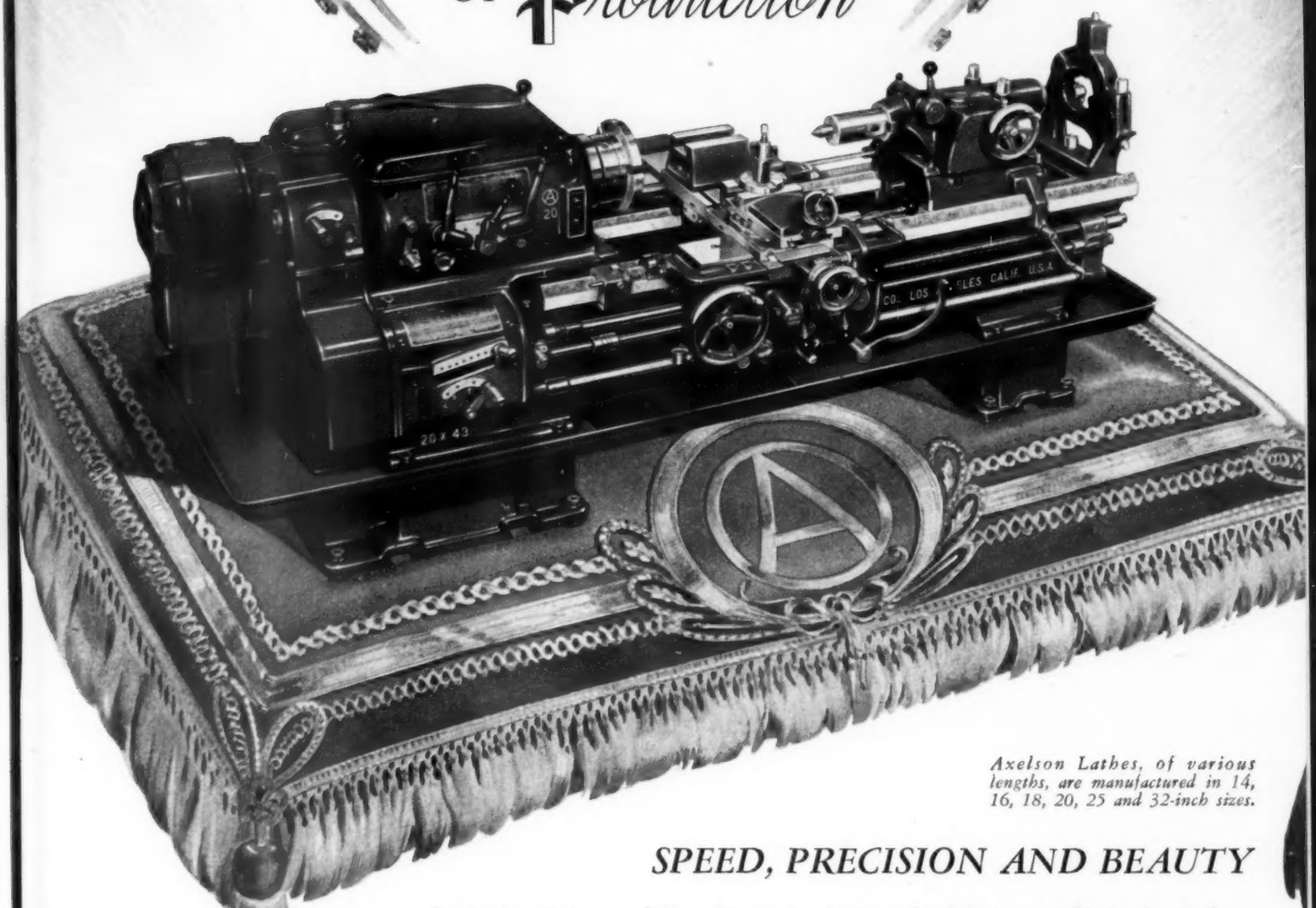
An attachment is also available which provides for automatic feeding of tapered cylindrical work. Hand feed may be used on this machine for finishing flat and irregular shapes.

Specifications

Capacity: (with power feed attachment) ¼" to 6" dia.
Speed leather cushion belt — 6300' per min.
Floor space—40"x50"
Motor—10 H.P.

PRODUCTION MACHINE CO.
Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

Crown Jewel OF Production



Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes.

SPEED, PRECISION AND BEAUTY

To the appreciative eye of the machine tool enthusiast, a fine lathe is a veritable jewel . . . Its facets flash in bright turned metals . . . Its colors glow on the smooth curves and planes of castings, steel and alloys . . . In the field of metal turning, the *Axelson Heavy Duty Lathe* is a gem among gems . . . a *crown jewel* of production . . . Over thirty years of intensive devotion to quality and improvement have gone into this great engine lathe . . . It is a one-plant product, developed from drawing board through foundry, machining and assembly, in the modern Axelson Works . . . From first to last, the job is supervised by men of veteran skill to whom the lathe is a life work, reflecting the thought and pride that moves with the machine . . . Versatile and dependable on every job, big or little, the Axelson Heavy Duty engine lathe will see you through, at every turn, with full confidence in your machine tool commitments and in their profit.

Consult your classified directory for the nearest Axelson dealer in your vicinity, or write, wire or telephone the Axelson Plant at Los Angeles or St. Louis.

MAINTAIN AND SUPPORT FREE ENTERPRISE

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Axelson Lathes

DEPENDABLE FOR OVER A QUARTER CENTURY

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LELAND-GIFFORD No. One MOTOR SPINDLE DRILLING MACHINE is built for quick and easy operation, all the controls, are at the Operator's Finger Tips. Built-in Work Lights, Ratchet Type Feed Levers, totally enclosed Ball Bearing Fan Cooled Motors. Four or Eight Speeds up to 9000 R.P.M. instantly available.

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No. 1 LMS Drilling Machines are no laggards. They are engineered to meet modern requirements for drilling holes from No. 80 to 5/16" diameter in Steel and 3/8" in cast iron.

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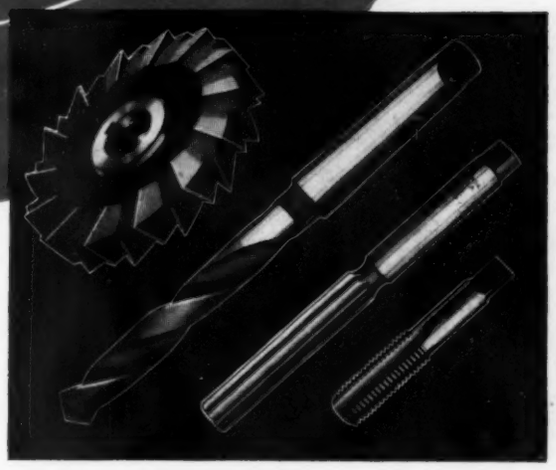
Accuracy

For mirror-finish precision reaming, always specify Morse Reamers. You'll see the difference in faster cutting, better work, and longer time between replacements. You'll find the same difference in all Morse Tools.

Morse Reamers and other Metal Cutting Tools are Made in Tungsten Carbide



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TWIST DRILL AND MACHINE COMPANY
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PLANER TYPE MILLER
Open side, as well as, those with a combination of Vertical and Horizontal Heads are incorporated in this line.

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Operations are continuous of the non-indexing type. 8 or 10 spindles available.

No. 1-A MILLER
One of a series of continuous operating milling machines adaptable to automatic or hand clamping.

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DOUBLE END HORIZONTAL DRILLER
12 to 24 Spindles—self feeding—continuous operation—automatic chain or hand clamping.

12 V VERTICAL DRILLER
Continuous operating having a capacity of 1½ in. in steel.

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Roughing and finishing cutter spindles in each column with finishing spindles adjustable for toe cut.

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Hollow steel frames of highest quality construction give a lifetime of accuracy. Special designs available.

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GREAVES No. 2

PLAIN or UNIVERSAL MILLING MACHINE

. . . for Speed, Accuracy, Production and Tool Room Work . . .

featuring:

- Power Feeds, all Directions
- Rapid Traverse—6-way
- Alloy Hardened Gears
- One Shot Lubrication to Table, Saddle Slides and Screws
- All Speed and Feed Changes through Positive Gearing
- All Speed and Feed Gearing run in Oil
- Timken Bearings
- Glass Sight Oil Control
- Unit Construction
- Central Control Position for all Operation Levers
- Coolant System

Specifications

Table—32¼" x 12"
Feed range—Longitudinal Power Feed 28"
Cross Power Feed 10"
Vertical Power Feed 19"
Overarm—4½" diameter
Spindle—Chrome nickel steel National Standard taper hole #50
Speeds—18—Range 20-1000 RPM Reverse on all speeds
Feeds—9—Range ½" to 18" per minute
Rapid traverse—Longitudinal—cross and vertical—All directions—75 per minute
Weight—3750 lbs.

Send for illustrated literature giving complete information.
Write for nearest agent or dealer

Exclusive Distributors

H. LEACH MACHINERY CO.

387 CHARLES STREET PROVIDENCE, R. I.

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!

Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request — Write!

BURKE MACHINE TOOL CO.

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THIS POPE SEALED MOTORIZED SPINDLE BELONGS ON *Your* 6" x 18" SURFACE GRINDERS

Its full 1 HP G-E motor is sealed-in. It runs at top efficiency, without attention. Dust, dirt, nuts, bolts and fingers are sealed out. Its extra large SKF Super-Precision, Double Row roller bearings and the thrust bearings are sealed in, too. No lubrication to worry about.

These exclusive features, combined with Pope precision craftsmanship, result in a spindle that will rough off surplus metal fast and then produce a superior finish.

Every 6" x 18" surface grinder needs to be equipped with this Pope Sealed-in Motor, Sealed-in Lubrication Unit

FOR FINER FINISHES AND PEAK PRODUCTION

Order one of these spindles and see for yourself.

Send us the name of your 6" x 18" Surface grinders and we will be glad to send you quotations.

No. 30

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ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
BUILDERS OF PRECISION SPINDLES

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POINTS WORTH NOTING ABOUT THE LINLEY MILLER AND JIG BORER

- Does small work on dies, jigs, fixtures, patterns, models accurately . . . at lowest costs.
- Fast setup, easy changeover. 8 Spindle speeds to 4250 r.p.m.
- Velvet-smooth feed. Direct micrometer setting . . . eliminates errors.
- Grease-sealed bearings need no adjustment.
- All rotating parts carefully balanced.
- Needs only 2½ sq. ft. floor space.
- Table size (7" x 17½") is ample.
- Table travels 10" lengthwise, 6" across.

Investigate these factors . . . relieve larger machines for work better suited to their higher rated capacities.

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LINLEY BROTHERS COMPANY
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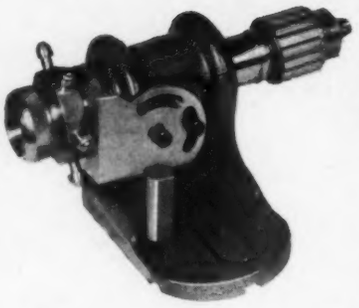
New Axial Relief GRINDING FIXTURE



TAKES THE PLACE OF COSTLY SPECIAL DUTY GRINDING MACHINES

A FIXTURE especially adapted to grinding cutting edges, steps, flutes and chip relief on milling cutters, burring tools, counterbores, countersinks, end mills, reamers, drills and taps. All adjustments simple, visual and external. Instantly adjusted to right or left hand. Automatic indexing equalized at all turns. Can be used on surface grinders as well as cutter grinders. Performs most jobs with standard grinding wheels.

Send for literature explaining simplicity of operation and illustrating a number of typical applications.

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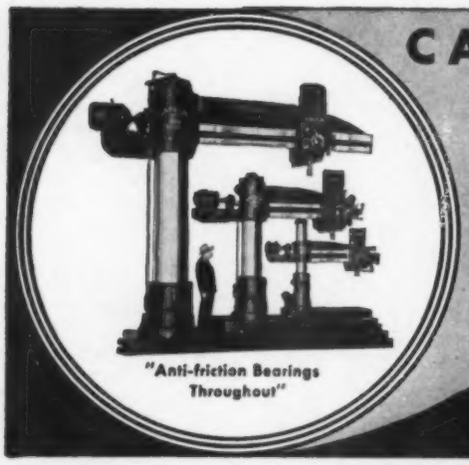
CARLTON RADIAL DRILL



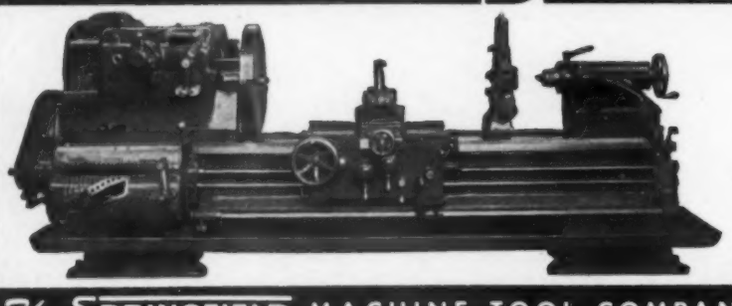
"Anti-friction Bearings Throughout"

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

SPRINGFIELD GEARED HEAD LATHES



for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

Over 100 Products to Help Machinery Serve Better!

IDEAL *"first Assistants"* In Modern Machine Shops!

Pictured above; (1) LIVE CENTERS, help speed production by making it possible to turn heavier loads, take deeper cuts, at higher speeds. (2) ELECTRIC TACHOMETERS, a new step in accurate machine speed measurement. (3) GRANITE SURFACE PLATE, for absolute accuracy to .0001 inch when laying out drill jigs, dies and fixtures. (4) DEMAGNETIZERS, remove metallic dust, flakes, fine chips, from tools, finished parts, etc. (5) GRINDING WHEEL DRESSERS, true and clean surfaces of grinding wheels. (6) BALANCING WAYS, improved model for static balancing, straightening, truing operations. (7) "MACHINE SHOP" METAL ETCHER, marks all smooth-surfaced iron and steel *permanently.*

These are only a few of the IDEAL line of production-speeding, money-saving equipment that includes over *100 products* serving more than *40,000 customers* through *200* IDEAL *Service Engineers.* Stocks carried at the factory, in warehouses, and with wholesalers in all principal cities. ***Ask for FREE 88-page Handbook.***

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IDEAL *Electric* MARKER

This brand new, streamlined marker is full of improvements that make permanent marking on all materials easier and faster than ever before—Lighter weight and better balanced. 30% more power. Marking Stroke adjustable to suit various materials and conditions. More rugged, sturdy construction, built to last. Permanently marks all metals, tools, parts, dies, etc.

Manufacturers of most complete line of Markers and Etchers.

1165

PROMPT DELIVERY

Machinery Products Division

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Successor to Ideal Commutator Dresser Co.

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This Mechanical
"BLACKSMITH'S HELPER"
Saves Time and Labor,
Increases Output

THE Blacker Hammer is unique—combining a motor-driven power hammer with a blacksmith's anvil, in one co-ordinated unit.

It enables one smith alone to do the work of a smith and two helpers.

It uses the blacksmith's familiar hand tools and methods.

It can deliver blows heavier and faster than hand blows—average blow several times as heavy.

Can deliver single blows.

Foot controls leave both hands free to manipulate work on the anvil.

Reduces the number of heats necessary per job.

Has no belts, pulleys or clutches.

Capable of use as a repetition production tool on certain types of operation.

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"The Mechanical Blacksmith's Helper" will give you all the details —pictures, description, cross-sections. Gives concise tabulation of advantages and savings a Blacker Hammer can bring you. Shows a typical set of anvil tools made with the Blacker. This book belongs in every blacksmith shop. Send for it and find out how a Blacker Hammer can speed operations for you and cut operating costs. Free—just mail the coupon.

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BLACKER HAMMER

MK-200

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Please send me Blacker Hammer Bulletin No. 56.

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PORTAGE

HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.*

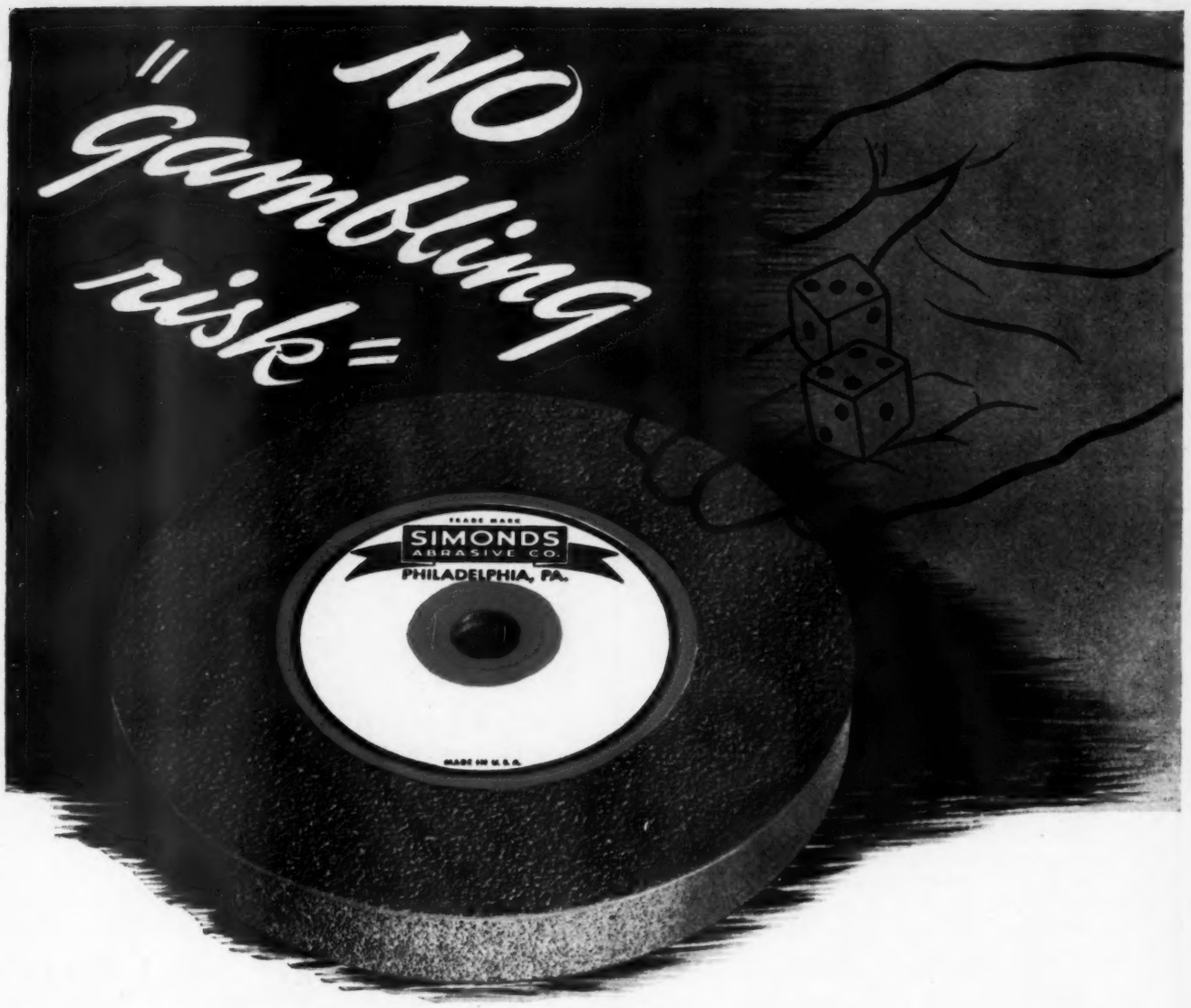
THE PORTAGE MACHINE CO.
AKRON 11, OHIO

Save three ways with Grand Rapids No. 10-B Combination Tap and Drill Grinder: 1. Lower first cost; 2. Less maintenance expense; 3. Valuable floor space.

Write for Bulletin 544

Grand Rapids 10-B Combination Tap and Drill Grinder

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.



Efficient means of selection—control in manufacture that leaves nothing to chance—economical, lasting sureness of performance—these are some of the winning qualities that swing the odds solidly in favor of peak production efficiency when you use Simonds Abrasive Wheels. Thousands of combinations of various types and sizes of grain in every required structure and bond make up the complete line of Borolon* (aluminum oxide) and Electrolon* (silicon carbide) products for all your production and tool room needs. For roughing, cutting, snagging or finishing, for effective, long lasting performance on any material from steel to plastics, Simonds Abrasive Wheels are your best bet. Grinding wheels of every size and shape; Segments, Mounted Wheels and Points; Grains, Bricks and Sticks give new economy and long lasting efficiency when used on the jobs for which they are intended.

You will find Simonds Abrasive distributors, located in all principal cities, eager and ready to help you select the particular Borolon and Electrolon product adapted to every specific job.

***Time-honored Borolon and Electrolon Abrasive products are now distinguished by the name Simonds.**

SIMONDS ABRASIVE CO. *is a Division of*

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Wilcolator* had a problem! Plastic casings for its heat controls were breaking at a discouraging rate when ordinary reamers were used to clean and true up the little brass insert moulded into them.

Then Wilcolator called on L & I for special reamers for this job. Here are their exact words as to the result. "On the very first run of 1200 pieces — and for the first time since we have been making them — we have had not a single loss through breakage, and not a single reject for failure to gauge properly even though the total tolerance is only 0.001"."

The same engineering skill that designed and built these special reamers for Wilcolator is exemplified in the regular line of L & I Standards. User after user is daily discovering that the L & I method of grinding after the solid bar is hardened produces a keener, faster-cutting, longer-lived edge, capable of more cuts and greater precision — higher production at lower cost.

Put L & I Reamers to work on your problems. They're available with straight or spiral flutes, in chucking, hand, rose, stub screw machine and taper pin types, in sizes from 1/16" to 5/16" and specials to order.

LAVALLEE & IDE, INC.
CHICOPEE, MASSACHUSETTS

*The Wilcolator Company
Elizabeth, N. J.

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Your KEY to MASS PRODUCTION
Will Speed up Drilling and Lower Costs

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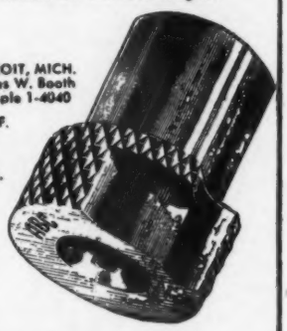

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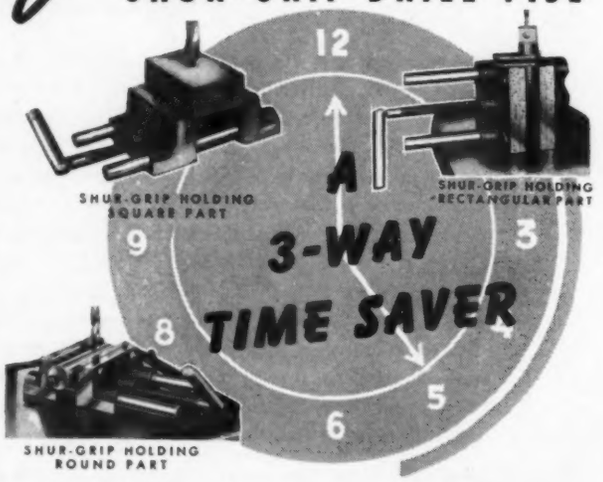

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Records for durability . . . for accuracy . . . for economy! They're being established regularly with the new Woodworth Adjustable Thread Ring Gage.

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H&G Insert Chaser DIE HEADS

Preferred By Makers
Of Screw Machine Products

An impartial canvass of the screw machine products industry revealed a decided preference for the H & G Insert Chaser Die Heads. Seventy-seven per cent of the respondents gave preference to this make.

Here's one reply from a western plant that uses three different makes of die heads: "*H & G Insert Chasers are more economical to buy and the hardening seems more uniform.*"

An Ohio firm using two different makes gives first choice to H & G, "*Because chasers are easy to change and very quickly set to proper pitch diameter . . . can be easily resharpened and used again. This Die Head is also good for threading close to shoulders.*"

These two reports show the trend and furnish food for thought to the head of any automatic screw machine department who is NOT NOW benefiting from the advantages of the high production, less down time, and very satisfactory performance of H & G Insert Chaser Die Heads.

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This handy device eliminates laborious calculations and gives the proper speeds for different materials for all diameters. FREE if requested on business letterhead. Otherwise, 15c.

Simple Strong Accurate

Sizes and styles for all machines on which threads are cut. Write for literature.

THE EASTERN MACHINE SCREW CORP.

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Manufacturers H & G General Purpose Die Heads, Insert Chaser Die Heads, Threading Machines, Feed Fingers

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DRILL 6 HOLES AT ONE STROKE!—ADJUSTABLE FOR ANY PATTERN

Multiply the production of every drill press . . . make your single spindle tools do the work of 6 with the Multi-Drill attachment. Six spindles are quickly and easily positioned to *any* hole pattern by simple adjustments of the locating arms. Fits any drill press. Standard Multi-Drill Spindles using 1/16" to 17/64" drill size handle any hole pattern on or within 5" circles—11/8" minimum centers.

SAVE:
- **Drilling time**
- **Set-up time**
- **Equipment investment**
- **Floor space**

NOTE: Special spindles are available to permit use of drills 1/16" to 3/16" diameter with corresponding minimum centers of 1/2" and 3/8".

Write for catalog sheets and complete details

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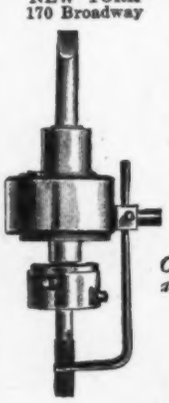
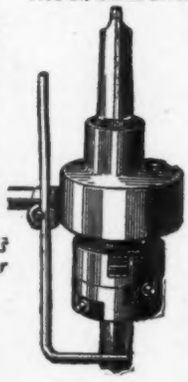


Size	Taps Exact Size
No. 00 H.S.	Up to 1/4"
" 00	1/16"
" 0	1/8"
" 1	5/16"
" 2	3/8"
" 3	5/8"
" 4	3/4"
" 5	3/4"



Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

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Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

THIS NEW *SUPER* TOOL BIT SAVES MONEY 7 WAYS!

Check These New *Super* Features For Lower Production Costs!

NEW *SUPER* EJECTOR-TYPE TOOL BIT

SUPER EJECTOR TYPE TOOLS
(Complete with 1 Carbide bit)

TOOL ORDER NUMBER		SHANK SIZE	SIZE SOLID CARBIDE INSERT
RIGHT HAND	LEFT HAND		
ER-1	EL-1	3/4x3/4x4 1/2	1/4x1/4x2
ER-2	EL-2	1x1x7	3/8x3/8x2
ER-3	EL-3	1 1/4x1 1/4x8	3/8x3/8x2
ER-4	EL-4	1 1/2x1 1/2x8	3/8x3/8x2
ER-5	EL-5	3/4x1x6	3/8x3/8x2
ER-6	EL-6	1x1 1/4x8	3/8x3/8x2
ER-7	EL-7	1x1 1/2x8	3/8x3/8x2

SOLID CARBIDE BITS for SUPER EJECTOR TYPE TOOLS

TOOL ORDER NUMBER		SIZE
FOR STEEL	FOR IRON, NON-FERROUS MAT., PLASTICS	
ES-1	EG-1	1/4x1/4x2
ES-2	EG-2	3/8x3/8x2

NOTE: Above bits are ground to fit holder, and require only sharpening at cutting end.

1. Bit-Holding Mechanism is inside where it can't interfere with free chip flow or assembly in tool block.
2. The heavy cross section of well supported Carbide insures the successful making of deep cuts and heavy feeds without cracking.
3. Absence of brazing strains due to mechanical holding of tip.
4. Tool life is doubled due to compound angles used. When the Carbide bit is ejected, it rises in the holder, permitting a light regrinding cut on top, end, and side, producing a new, sharp cutting edge with the absolute minimum loss of Carbide.
5. No steel is removed in grinding, insuring rapid and economical reconditioning of the tool.
6. Replaceable Carbide bit is extra long for longer life.
7. Each holder can be used for machining any material. Replaceable Carbide bits are furnished in proper grade for each job.

SUPER TOOL COMPANY

Carbide Tipped Tools

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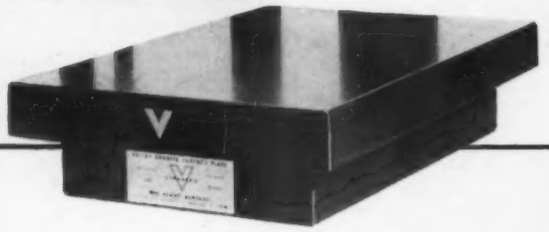
SURFACE PLATES
ARE
OLIVINE DIABASE



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Commercially known as black granite, *Olivine Diabase* is actually similar to basalt. It approaches the diamond in hardness (7:10). It is 15% heavier than granite and only 1/30th as absorptive.

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The Master Series of VELSEY Black Granite Surface Plates are finished to .00005" surface accuracy. Considerably lower in price, the Standard Series are finished to .0001" surface accuracy. Regular sizes in both series are 12" x 18", 18" x 24", and 24" x 36".

Special sizes are made to order. There is practically no limit to the possible dimensions.

Thousands of VELSEY Black Granite Surface Plates are giving extraordinary satisfaction. If you are not acquainted with these superior surface plates, it will pay you to order one or more soon and learn their advantages by actual use.

MAIL COUPON or write for particulars. Also indicate if you desire information on STATE TOOLS.

STATE MANUFACTURING & CONSTRUCTION CO.
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Send complete information on VELSEY Black Granite Surface Plates; also on ☐ DIALSET Boring Tools and ☐ Four-Cutter Boring Bars.

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ECONOMY Grinding and Cutting Oils and Lubricants
for Every Metal-Working Purpose
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Explains how CrysCoating can cut costs, speed up production, reduce rejects on your finishing operations. In-plant demonstration of the Oakite CrysCoat Process on your work gladly arranged for on request. Inquiries involve no obligation. Write today.

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WALKER'S appreciate their obligation to the Metal Working Industry in anticipating and solving customer requirements.

WALKER Engineers, with over half a century of background and experience, are qualified to offer the right solutions to magnetic holding problems.

WALKER CHUCKS are universally used throughout the world.

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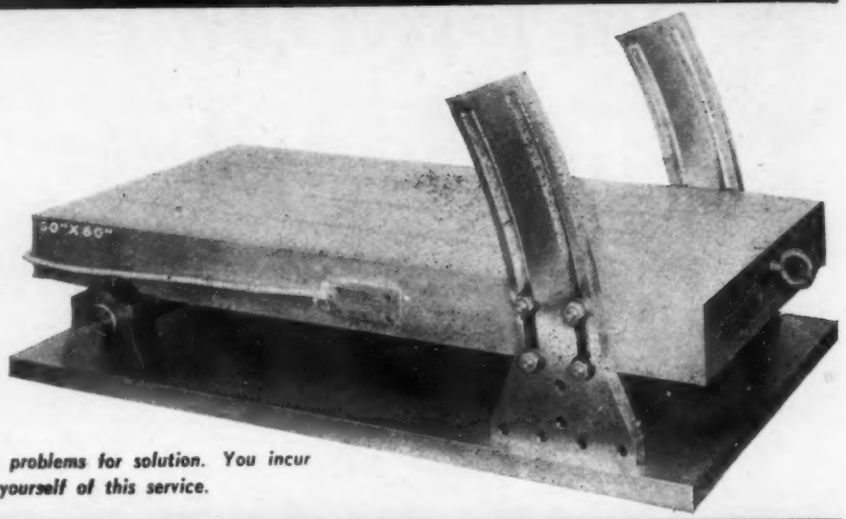

WALKER invites you to submit your problems for solution. You incur no obligation in availing yourself of this service.

Walker Chucks

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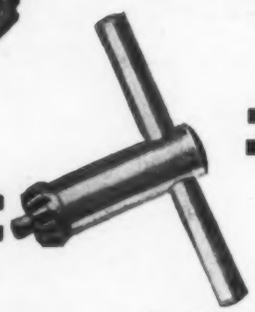

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Types and sizes are available to fit all machine tools and portable drills.

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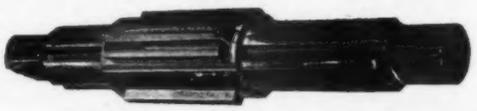

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are accurate, reliable and built to stand the gaff of hard usage.

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9" CUTTING FLUTES—12' LONG DRILLS

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9/64"	12	9	1.50	11/32"	12	9	2.25
5/32"	12	9	1.50	23/64"	12	9	2.50
11/64"	12	9	1.50	3/8"	12	9	2.50
3/16"	12	9	1.50	25/64"	12	9	2.75
13/64"	12	9	1.60	13/32"	12	9	2.75
7/32"	12	9	1.60	27/64"	12	9	3.00
15/64"	12	9	1.75	7/16"	12	9	3.00
1/4"	12	9	1.75	29/64"	12	9	3.25
17/64"	12	9	1.85	15/32"	12	9	3.25
9/32"	12	9	1.85	31/64"	12	9	3.25
19/64"	12	9	2.00	1/2"	12	9	3.25
5/16"	12	9	2.00				

HIGH SPEED STEEL, TAPER SHANK

TWIST DRILLS

EXTRA LENGTH

SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET	SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET
17/32"	15	12	$6.50	27/32"	15	12	$11.50
9/16"	15	12	7.00	7/8"	15	12	12.00
19/32"	15	12	7.50	29/32"	15	12	12.50
5/8"	15	12	8.00	15/16"	15	12	13.00
21/32"	15	12	8.00	31/32"	15	12	14.00
11/16	15	12	8.25	1"	20	15	16.00
23/32"	15	12	8.50	1-1/16"	20	15	17.00
3/4"	15	12	8.50	1 1/8"	20	15	18.00
25/32"	15	12	9.50	1-3/16"	20	15	20.00
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When hard usage wears down the teeth of ordinary files, let long-lasting "AMERICAN SWISS" Swiss-Pattern files take over. Made of the highest grade file steel and specially heat-treated to maintain uniform hardness, these Swiss-Pattern files have always been noted for their *durability*.

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AMERICAN SWISS FILE & TOOL CO.
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SWISS PATTERN FILES

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. . . the tool that converts drilling machines into key-seaters and saves time and money

• With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

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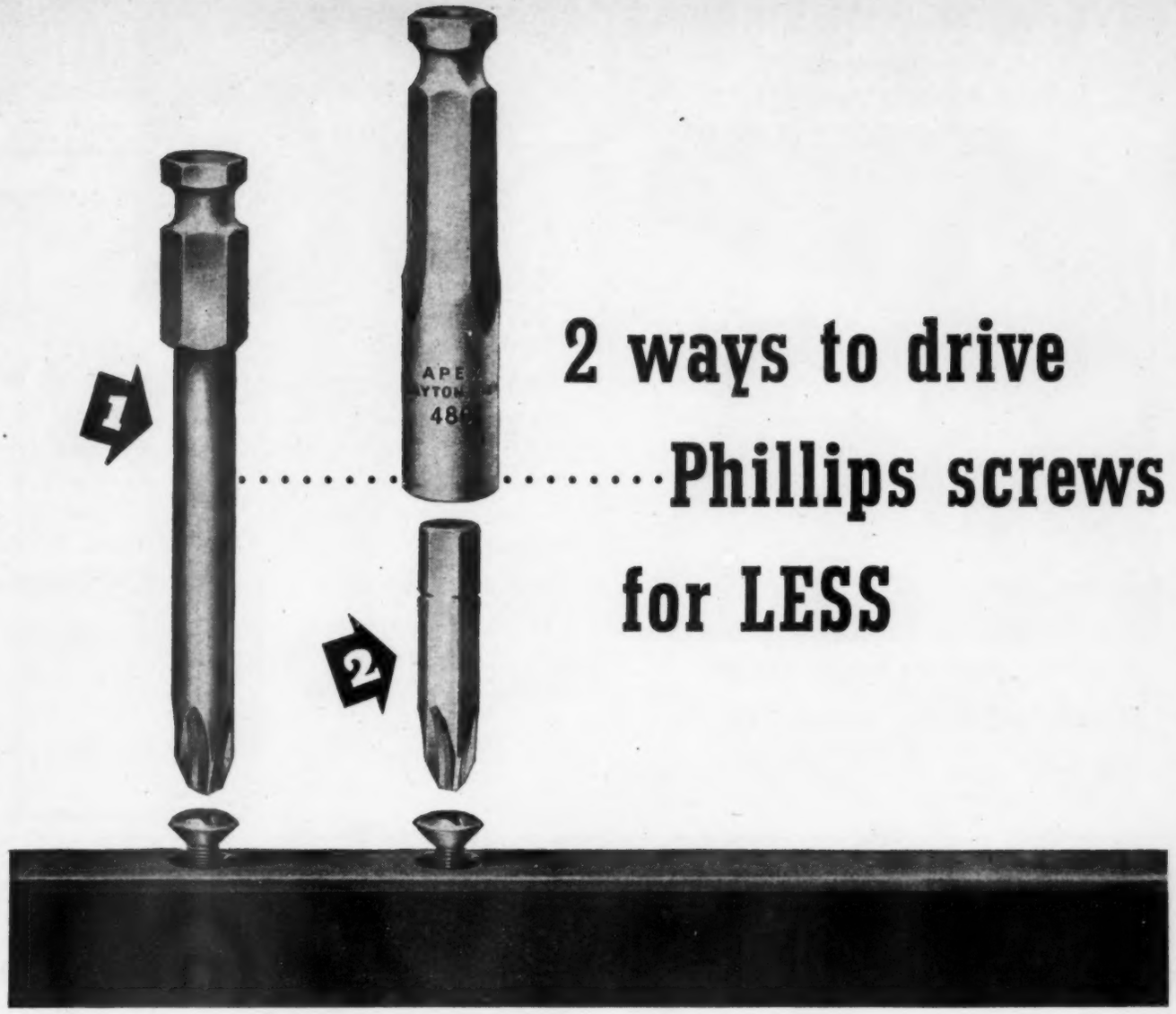


2 ways to drive Phillips screws for LESS

... and they're both BEST!

1. Best for driving Phillips screws in close quarters, when you need a bit of minimum diameter. By returning worn bits to Apex for complete reconditioning, you can multiply service life many times — actually get eight lives per inch of bit. The cost: a fraction of the price of new bits. Shanks: for all your electric, pneumatic, or spiral drivers.

2. Best for driving screws where space permits the slightly larger OD of the Apex exclusive bit holder, with the replaceable insert tip. Once you get holders for your drivers, it's a cinch to stock *four sizes* of tips to fit practically all your bit holders and drive the full range of Phillips screw sizes. Tips float in holders, seat more easily in screw recesses, simplify bit inventory, give maximum service.

Write today for Catalog 15 on Apex standard power bits and Bulletin 102 on Apex insert type bits.

THE APEX MACHINE AND TOOL COMPANY, DAYTON, OHIO

APEX screwdriver bits

Safety Friction Tapping Chucks; Quick Change and Positive Drive Drill Chucks; Vertical Float Tapping Chucks; Parallel Floating Tool Holders; Power Bits for Phillips, Slotted Head and Clutch Head Screw Drivers; Hand Drivers for Phillips and Clutch Head Screws; Aircraft and Industrial Universal Joints; Sockets and Universal Joint Socket Wrenches.

SAVE HANDS WITH STRANDS
Safguards
FOR PUNCH PRESSES

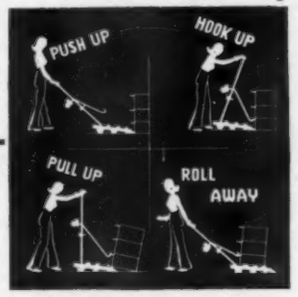
Write for descriptive bulletins to get the important facts

STRAND MANUFACTURING CO., INC.
SAFETY ENGINEERS
600-13 WEST LAKE ST. CHICAGO 6, ILL.

MEET ROLOCK'S "George"

Meet him you must . . . on your factory floors. Put him to work thus . . . simply slip traction hook into box handle, pull back and your heaviest laden tote box glides over the beveled frame edge up onto the rollers with "the greatest of ease." Then lead it around anywhere with no more effort than to keep it rolling. "George" is a sensation . . . Ask for Bulletin A.

ROLOCK, INCORPORATED
Fairfield, Connecticut



LET "George" DO IT
TRADE MARK

REED-PRENTICE

LATHES
JIG BORERS
DIE SINKERS
DIE CASTERS
VERTICAL MILLERS
INJECTION MOLDERS

REED-PRENTICE CORP.
WORCESTER MASS U.S.A.

LUERS
Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

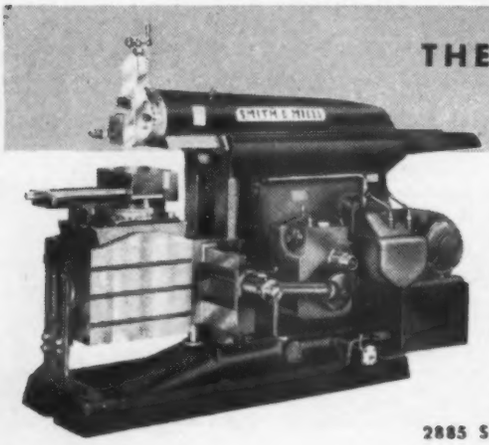
DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1¼ in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

THE CRANK SHAPER WITH THE "PATENTED RAM"



High quality engineering design and manufacture enable Smith & Mills Crank Shapers to handle easily all types of jobs within the individual machine's range with precision and power to spare. A wide range of feeds and speeds, plus simplicity of operation, makes for efficient, low-cost production. Shaper sizes 12" to 32" are fully described in S & M's latest catalog—yours for the asking.

THE SMITH & MILLS CO.
2885 SPRING GROVE AVE., CINCINNATI 25, OHIO

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.

RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

...from tiny acorns grow

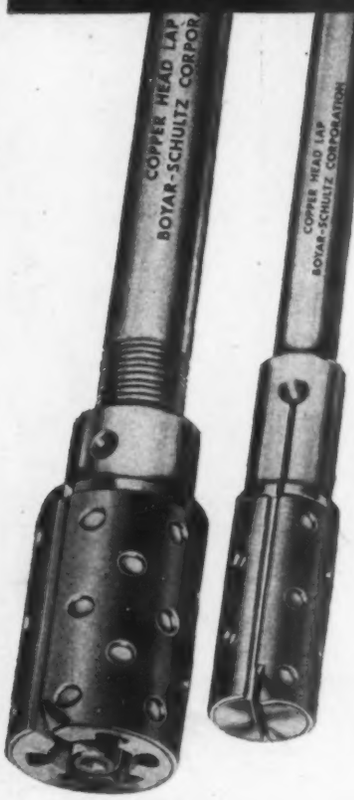
Lovejoy's business is based on a sound idea. Small in size? Yes. Big in importance? Yes. This sound idea is the "Positive-Locking" device used to secure the cutting blades in Lovejoy Milling Cutters. It consists of just two parts — the serrated shoe and the locking wedge. Tools needed for blade adjustment consist of a pin and hammer.

It is simplicity itself, yet blades are held immovably, even under the strains imposed by negative rake carbide cutting practice — even when these cuts are intermittent.

Lovejoy makes superior milling cutters—has experienced engineers to help on any standard and special applications—has a range of models and sizes for every job—has nationwide service for your convenience.

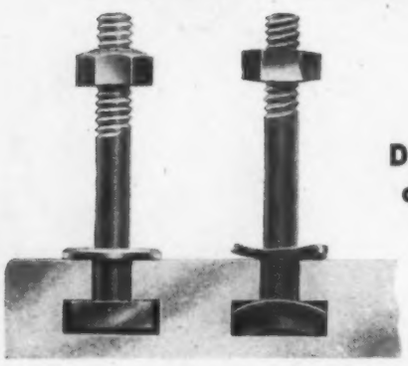
LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

COPPER HEAD LAPS



. . . they pay for themselves in time saved! They work fast; they never wear out. The only wearing part is the replaceable sleeve. Sleeve adjustment feature permits maintaining correct lapping size till worn out and replaced with a new sleeve. Costly toolroom time is saved by using Boyar-Schultz Copper Head Laps. Available from stock in standard sizes 1/8" to 2 1/2".

SPECIAL MACHINE BOLTS



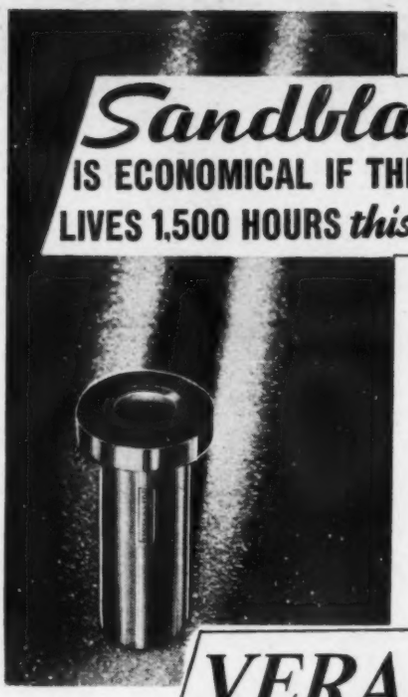
"Avoid Deliberate Ruin of Machinery"

"Most metal working machinery is provided with T-slots in Tables for fastening work. In modern production these T-slots are completely finished by milling or planing; consequently every surface is finished smooth and square. But when machines are put in operation, any kind of hodge-podge bolt is used for fastening work. It does not take long to ruin T-slots with such bolts, and after that has happened, a most essential part of the machine is ruined. The cost of proper bolts is small, and I hope that my observation expressed here will reach the men in authority to *avoid this deliberate ruin of American Machinery.*"

Above is from a letter to Tool Engineer, January, 1946.

Boyar-Schultz Special T-Slot Bolts are made from upset forgings of heat treated alloy steels. Machined heads are square with bodies to present a clean flat surface to T-slot. Threads are carefully cut. For best results use Nuts and Washers made for use with Boyar-Schultz Special T-Slot Bolts.

BOYAR-SCHULTZ
CORPORATION
2109 WALNUT STREET CHICAGO 12, ILL.

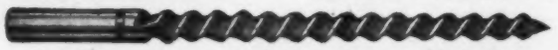


Sandblasting
IS ECONOMICAL IF THE NOZZLE LIVES 1,500 HOURS *this one does*

VERALOY
CEMENTED CARBIDE

VERALOY PRODUCTS LTD
THE MARSH · HIGH WYCOMBE · BUCKS · ENGLAND

HOLMAN *BETTER, FASTER HOLE FINISHING*



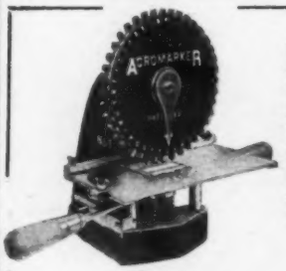
HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

METAL CLEANING & DRYING ENGINEERS, INC.
328 GRAHAM ST., HIGHLAND PARK, N. J.
We Design and Build the Equipment

WHAT IS YOUR PROBLEM?



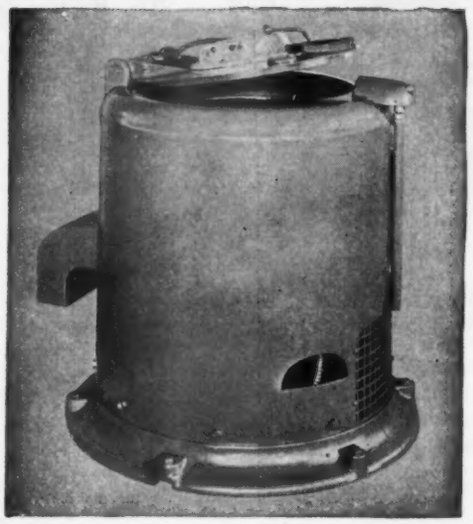
The ACROMARKER is a remarkably easy-to-operate marking machine offering faster, more accurate marking than heretofore possible. Widely used in industry, this model weighs only 30 lbs. It stamps letters and figures in straight or curved lines. With it unskilled help can do the work of skilled men faster and accurately.

Write for literature

The **ACROMARK** *Company*

7-13 MORRELL ST., ELIZABETH 4, N. J.

DRY SMALL PARTS QUICKLY and ECONOMICALLY with BARRETT CYCLONE CENTRIFUGAL DRYERS



The Barrett Centrifugal Dryer — efficient, self-contained, and compact is built in several sizes.

• The Barrett Parts Drying Process centers around a method of creating a guarded cyclone.

In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

Direction of basket rotation can be quickly reversed which will change position of the load and accelerate drying. Baskets are available in shapes which experience has shown to be most effective for handling various classes of work.

It will pay to investigate the advantages offered by Barrett Centrifugal Dryers on your work.

Full Details of the Barrett Cyclone Dryer Sent Promptly on Request.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

now available

PRECISION GEAR CAPACITY

generating • grinding • shaving

The Niagara Falls plant of Bell Aircraft now offers substantial precision gear-manufacturing capacity, including $200,000 new equipment, to interested manufacturers.

We can handle:

1. Gleason straight bevel gears up to 12″ O.D.
2. External spur gears up to 12″ O.D.
3. Internal spur gears up to 15″ O.D.
4. Spiral bevel gears up to 18″ O.D.

(All necessary heat-treatment for gear-cutting available.)

Bell is also equipped to handle electrical cable and wire work assembly, and tube bending assembly up to 2″ O.D. We also have Plexiglas forming capacity, and top-grade anodyzing and plating capacity. Brown & Sharpe automatic up to 1″ O.D. For information write to Dept. 3.

BELL *Aircraft* CORPORATION

P.O. Box 1, Buffalo 5, N.Y.
Designers and builders of Airacobra, Kingcobra, Airacomet and the Bell Helicopter

of TRIMMING FORMED PARTS

and performing a host of other metal cutting jobs!

The negligible down-drag and the ability of Tannewitz High Speed Band Saws to cut sheet metal from 90° to near 0 or 135° at tremendous speed make these machines ideal for trimming. Cuts can be made with perfect safety without using a rest of any kind. Friction sawing with Tannewitz High Speed Band Saws also results in perfectly amazing time savings in the cutting of flat sheets, soft or hardened steels, armor plate, plastics, glass and many other materials. Whatever your cutting problem, chances are it can be done better and faster with Tannewitz Band Saws. Investigate this "Super" method of cutting.

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FRICTION SAWING *with* **Tannewitz**

HIGH SPEED BAND SAWS

THE TANNEWITZ WORKS GRAND RAPIDS 4, MICHIGAN

EDWARD
Blake
COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

ONLY the BLAKE TAP GRINDER has ALL these features of VERSATILITY and SPEED:

- Sharpens *all kinds of taps* (special models for spiral point, tapper and staybolt taps).
- Allows grinding of *any desired relief and chamfer angle.*
- Sharpens right-hand *and* left-hand taps *without any change* in the machine.
- *No extra equipment* is necessary for sharpening 2, 3, 4, 5, 6, 8, or 10-flute taps.
- *Your choice* of method of holding taps:
  No. 0 to ½": *on O.D. of thread*
  No. 0 to ⅝": *on the shank*
  No. 0 to 2": *on centers.*
- *Also* sharpens step drills 3- and 4-flute drills, countersinks, the lead on reamers, and many other tools requiring relief on the point.
- A special adjustable eccentric mechanism which allows *both* the chamfer angle and the relief—of all the lands—to be ground in *one continuous operation.*

Mail the coupon today for complete details.

No machine is better than the cutting edge of the tool it uses.

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail. A.M.

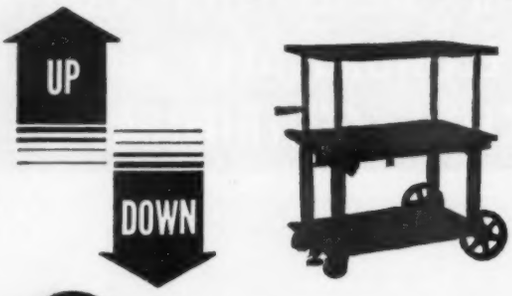
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS



PORTELVATOR is the handiest necessity in any plant. Moves heavy material without strain. Raises. Lowers. Then moves again to the next operation.

Used to support overhanging work. To lift heavy castings. To load and unload. To transport supplies. Used in a thousand ways to expedite the work and lessen the strain of lifting and holding. Even used as a portable work bench.

Many models in stock. Special models designed and built to fill your particular need.

Write for literature and prices. Now! And be prepared to solve a problem when production pushes for attention. Address Department D.

THE *Hamilton* TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS
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HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE

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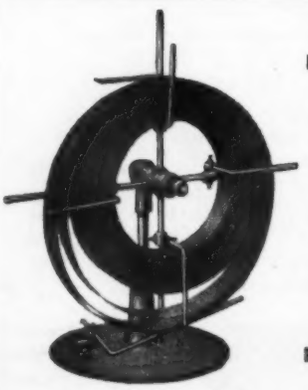
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090

LITTELL REELS

FEED COIL STOCK FASTER



No. 3 Littell Reel. 300 lbs. capacity. For coil stock.

COIL stock can be loaded, centered and unreeled faster with LITTELL. Automatic Centering Reels. They increase production.

Littell Reels are ball-bearing, easy running, strong, durable. Capacities 100 to 20,000 lbs. Spindle and cradle, plain and motor-driven types.

Request Bulletins

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PAGE *Welding* ELECTRODES

Welding Economy Begins in the Front Office . . .

The right electrode . . . correct welding technique—these add up to economy in production welding. Page offers both: A complete line of electrodes and gas rods (with emphasis on PAGE-Allegheny stainless steel)—plus the benefit of the experience of PAGE selected distributors and PAGE Service Engineers. For uniformly high quality electrodes and rods and information about their most efficient use—get in touch with your PAGE distributor.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

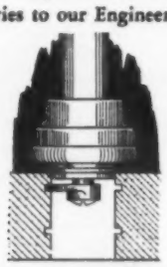
PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

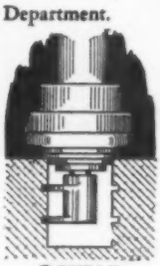
The LYON TOOL + your own DRILL PRESS = PRECISION GROOVES

It's as simple as that, and, furthermore, production runs can be made by any unskilled worker.

The Lyon Internal Grooving Tool cuts precision internal grooves in cylindrical bores and housings at a saving of time and cost which was hitherto thought impossible. One of your toughest problems now becomes one of your simplest. Thanks to the ingenious engineering incorporated in this tool, unskilled workers can produce grooves of exact depth, width, and location — up to 350 pieces an hour — and work can not be scratched or marred because the head of the tool does not turn while the cutter operates. Grooves may be located from top or bottom of hole. It is as easy to cut multiple grooves as single ones. For further information and complete technical data, address your inquiries to our Engineering Department.



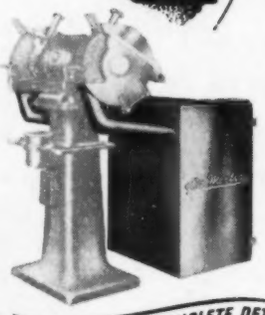
SINGLE GROOVE LOCATED FROM TOP OF HOLE



DOUBLE GROOVE LOCATED FROM TOP OF HOLE

LYON MACHINE CO., WORCESTER 3, MASS.

OUT OF THIS WORLD!



THE AIR MASTER keeps dust and grit out of your plant... instantly sucks them from the whirling wheels of your grinders and buffers. Dust and grit, tiny but destructive enemies of health and machinery, are completely eliminated right at the moment they fly off the wheels.

The AIR MASTER keeps the air clean. It provides healthful working conditions for your employees . . . keeps expensive machinery in working order by protecting delicate bearings and moving parts.

Install the AIR MASTER in your plant. It is fully self-contained . . . efficient, rugged, dependable. A size for every grinder and buffer.

WRITE TODAY FOR COMPLETE DETAILS

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ELECTRIC DRILLS · GRINDERS
BUFFERS · PORTABLE TOOLS
AIR MASTER DUST COLLECTORS

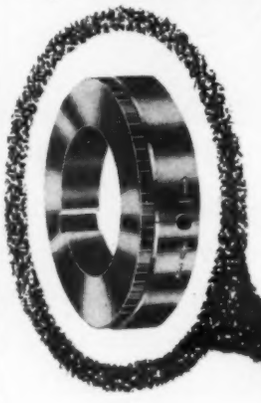
THE CINCINNATI ELECTRICAL TOOL CO.

Division of THE R. K. LeBLOND MACHINE TOOL CO.

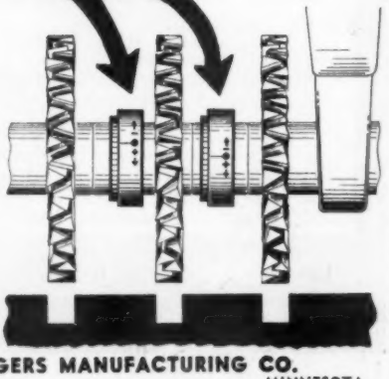
2815 MADISON ROAD · · CINCINNATI 8, OHIO

MICROMETER ADJUSTMENT

on side milling cutters and gang milling setups with Dayton Rogers Micrometer Adjustable Spacing Collars



You can make an adjustment QUICKLY — ACCURATELY on all milling machine setups with these collars by merely loosening the cutter arbor nut and making an adjustment as required. Graduated in thousandths, an adjustment of .0005" can be made very readily by visual calibration.



Made in twelve standard sizes from 7/8" to 2" for immediate shipment. Each collar furnished with spanner wrench for making adjustments.

Write for Bulletin No. 120-1.

DAYTON ROGERS MANUFACTURING CO.

MINNEAPOLIS 7 MINNESOTA

GIANTS of PRODUCTION!

Look ahead . . . get ahead . . . keep ahead with Buhr Retooling.

Buhr engineers are specialists in retooling equipment for Multiple-Spindle Drilling, reaming and tapping operations.

by **BUHR**

Retooling consists of a fixture for clamping part. Right hand head (above) has 82 spindles; left hand head has 38 spindles with a sliding bushing plate for removal of part from fixture. Heads have oil pumps for positive lubrication and shaved gears for quietness.

SEND YOUR BLUE PRINTS OR WRITE US ABOUT YOUR PROBLEMS

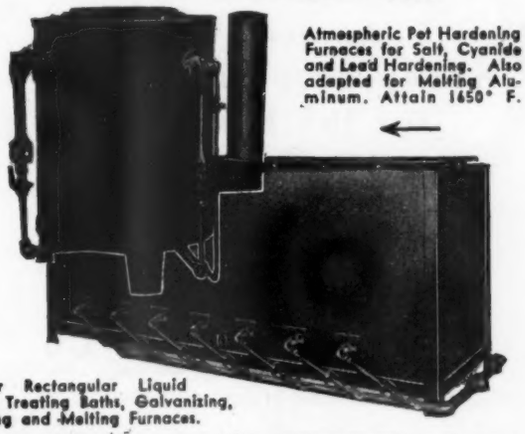
BUHR MACHINE TOOL COMPANY
837 GREEN & DAVIS
ANN ARBOR, MICH.

✓ PLAN TO INSTALL

BUZZER
Reg. U.S. Pat. Off.

INDUSTRIAL *Gas* EQUIPMENT

NO BLOWER or POWER NECESSARY
. . . just connect to gas supply



Atmospheric Pot Hardening Furnaces for Salt, Cyanide and Lead Hardening. Also adapted for Melting Aluminum. Attain 1650° F.

Buzzer Rectangular Liquid Heat Treating Baths, Galvanizing, Tinning and Melting Furnaces.

Send for the complete "BUZZER" Catalog

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Oil-Hole Subland Drills

Straight Shank Subland Oil Hole Drill

Morse Taper Shank Subland Oil Hole Drill

NEED SUPERIOR QUALITY CUTTING TOOLS ?

PROMPT SERVICE

Oil hole drills
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Oil hole subland reamers
Subland drills
Subland reamers
Circularity relieved reamers
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Combination drill and reamer
Special drills and reamers
Line reamers
Core drills
Special center drills
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Special Tools To Your Specification

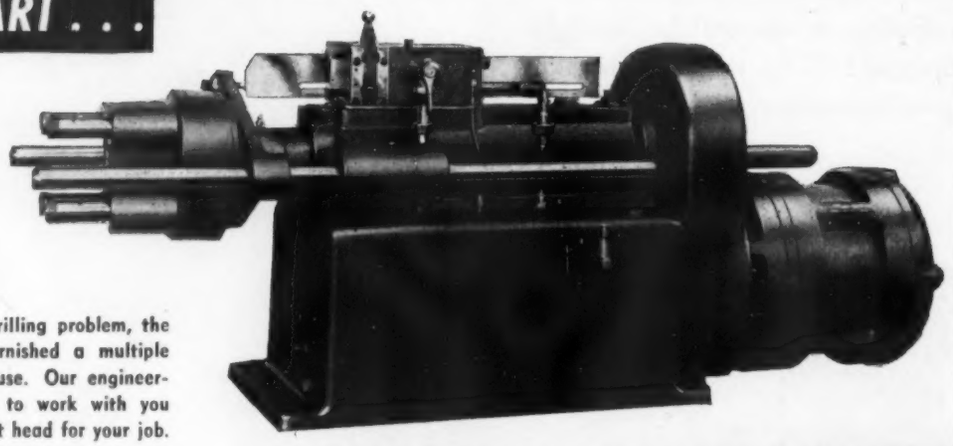
Write for QUOTATION

DETROIT REAMER & TOOL CO.
2830 E. 7-Mile Road
Detroit 12, Mich.

4 SPINDLE HOEFER HEAD ELIMINATES SEPARATE HANDLING OF AN UNWIELDY PART . . .

★ A 5 H. P. Hoefer Hydraulic Unit on which is mounted a 4-spindle Hoefer Head carried on guide bars. Tied into the fixture through a mounting bracket, the head became a part of a large Ingersoll Multi-Station Boring Machine performing operations on a tractor crank case. The four holes are at a 30-degree angle to all other operations and are done during the time of the other operations. The control is hydraulic, automatically starting our unit with its 4-spindle head by the index plunger of the trunnion entering its bushing. In this way a separate handling of an unwieldy part was eliminated and the extra jig for these holes was not necessary.

In our more than thirty years of concentrated effort in designing and building Multiple Spindle Heads we have produced this equipment for unlimited applications and in designs of every conceivable construction.



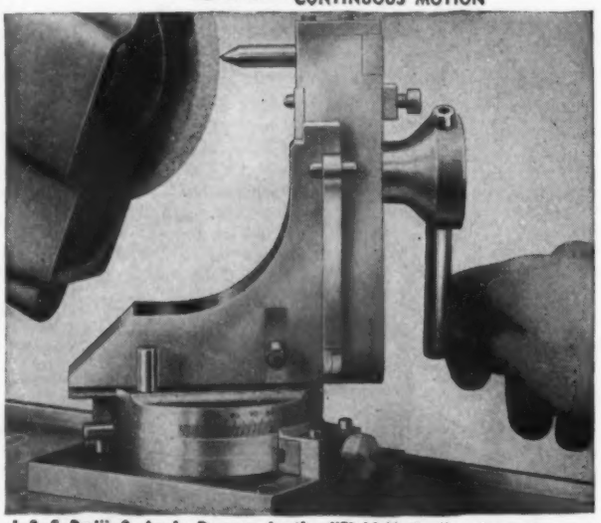
If you have a multiple drilling problem, the chances are we have furnished a multiple spindle head for similar use. Our engineering department is ready to work with you now to determine the right head for your job.

Hoefer's Whole Business is Holes . . . .

HOEFER MFG. CO. *Freeport, Ill.*

USE *Fluid-motion* for modern form-dressing

ONE SETTING HANDLE CONTINUOUS MOTION



J & S Radii & Angle Dressers in the "Fluid-Motion" series are among the finest precision dressing instruments procurable. . . . regardless of cost. There is a standard model to fit most form-dressing requirements.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
7" & 14" wheel capacities
Large range yet compact
Chatterless and dustproof

J. & S. TOOL CO.

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EAST ORANGE 1, N. J.

Better cutting fluids mean Better Machining

Stuart's *ThredKut*

. . . America's No. 1 heavy-duty cutting Oil for the toughest metal cutting jobs!

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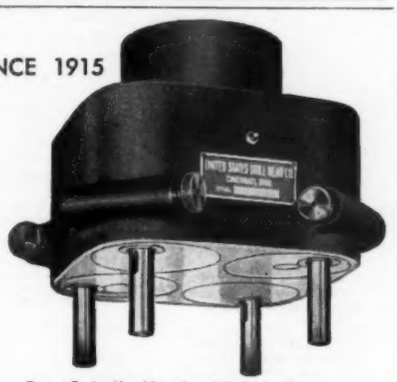

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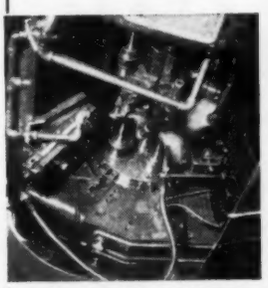

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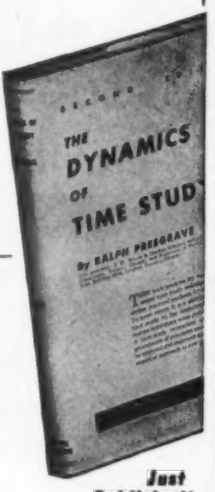
The "why" of TIME STUDY—

A guide to sounder, more equitable time-study practices . . . critical appraisal in terms of basic philosophy



TIME study is in the unfortunate state of having spread enormously in a short time without having improved and advanced appreciably in precision, manner and consistency. Here is a book by a practiced time-study engineer that re-examines the whole field of time study from a reasoned rather than a rule-of-thumb approach. It analyses its basic objectives, its principles, terminology, its importance to scientific management, its relation to motion study—to evolve a basic line of thinking in order to move toward more consistent and intelligent time-study techniques.

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PHIL CARROLL, Jr., says in his Foreword:

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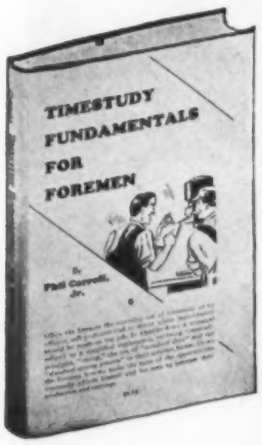
An ABC book of timestudy to help you get bigger output



Stressing exactly the problems the foreman encounters in making a timestudy and in applying new, improved standards, this straightforward manual shows just how to go about making the study, tells what to do in order to get the most out of the study, in bigger and better output and in improved working methods.

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(Continued on page 313)

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Additional Employment Advertising on page 313

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#2A Warner & Swasey Universal
#6A Potter & Johnson Automatic Chuckers.
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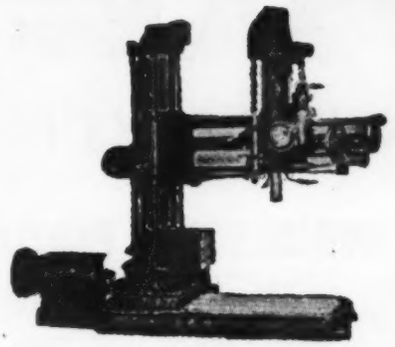

Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

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#3, #4, #5 Cinn. High Power, Plain, S.P.D.
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P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#2½ LeBlond Universal.
#3B Hendey Universal Miller, motor drive.
1—Cincinnati #4 Vertical Milling Machine, H.P., S.P.D. Geared feeds and speeds.
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5' Arm, 14" Column Fosdick, motor drive.
5' Arm 14" Col. Fosdick.
6' Arm, 15" Column Cincinnati-Bickford

GRINDERS

1—#3 LeBlond Tool and Cutter, Motor Drive
1—#11 B & S Plain Cylindrical, SPD.
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.

Blanchard Grinder #16, 30" dia. magnetic Chuck, 25 HP 3-60-440 V Motor.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M.T.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Com Press. Plain flywheel drive, double roll feed.

SHAPERS & GEAR CUTTERS

#1 Adams Gear Hobbers, Belt driven (3).
21" Smith & Mills B.G. Helical Gears.

MISCELLANEOUS

Thomson Cutter and Creaser, 12½ x 18½.
Heat Treating Furnaces for the tool room.
Hydraulic Pumps—Hele Shaw, Racine, Oil Gear, Motor Driven.
Blake and Knowles 12 x 2 x 12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½. New this year.
#5A High Speed Riveting Hammer.
Baker #0 Keyseater 1" x 9" Cap.
1—Paragon Continuous Blue Printing Machine, complete with dryer, motor driven
Shuster ½" capacity Wire Straightener & Cut-off Machine, up to 40' length.

Waterbury-Farrell Cold Header, double stroke, open die, ½" x 6".
Manville #3—⅜" Thread Roller
#30 Waterbury-Farrell Thread Roller. New 1943.
#20 Waterbury-Farrell Thread Roller, Hand Feed.

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BROWN & SHARPE #2 light type—latest
BROWN & SHARPE No. 2B, No. 4B standard type—Timken Bearing—latest type
CINCINNATI #2 Timken Bearing—Dial Type—latest type
CINCINNATI #5 motor drive
KEARNEY & TRECKER No. 2H, No. 3H Timken Bearing—latest type
KEARNEY & TRECKER No. 2K, No. 3K—Timken Bearing—latest type
KEARNEY & TRECKER #2A Timken Bearing—latest type
KEMPSMITH No. 4 Maximiller—Timken Bearing—latest type

● MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI No. 2, No. 3 Timken bearing—Dial Type
GORTON No. 8½D Vert. High Speed—latest type
KEARNEY & TRECKER No. 2H, No. 3K—Timken Bearing—latest type

● MILLING MACHINES—Manufacturing

BROWN & SHARPE No. 10, 12 Auto. Timken
CINCINNATI 45x48 Hydro, Timken Bearing—latest type
CINCINNATI 4-36 Hydro. Timken Bearing—latest type
CINCINNATI No. 0-8 Vert. & Pl. Auto. Timken Bearing—Latest type
CINCINNATI No. 1-12, No. 1-18 Plain Automatic Timken Bearing—latest type, Rise & Fall
INGERSOLL 24x24x8' Planer type—1 head
INGERSOLL 36x48x18' Planer type—4 heads
INGERSOLL 42x36x16' Planer type—4 heads
KEARNEY & TRECKER No. 1218 Auto. Timken Bearing—Latest Type
KENT OWENS No. 2 RV Hand Miller—Timken Bearing—latest type
MOREY No. 12M—2 spindles Profiler and Milling Machine
OHIO Auto. 36" table—Timken Bearing—latest type

● THREAD MILLING MACHINES

PRATT & WHITNEY 4½x12, 6x20 Model B, Model C latest type
PRATT & WHITNEY 6x120, 6x132—motor drive
MOREY SHIELDS 12x30, 12x60, 12x120, 12x192—latest type

● SHAPERS

DILL 18" Vert. Shaper—slotter—M.D.
JONES 6" Vertical—latest type
LAMAIRE Vertical Hydraulic—latest type
MOREY 10", 14" Vertical—latest type
MORTON 30" Draw Cut
PRATT & WHITNEY 6" Vertical Motor drive
PRATT & WHITNEY 10" Vertical M.D.
RHODES 7" Comb. horiz & vert.

● GRINDERS—Surface

ARTER 8" Rotary Surface
ARTER Automatic Piston Ring
BLANCHARD #16A-26" Chuck motor drive
BLANCHARD #16—26" Chuck—motor drive
BLANCHARD #18—30" Chuck motor drive—latest type
GALLMEYER & LIVINGSTON No. 25 6"x18"—Hydraulic—latest type
GALLMEYER & LIVINGSTON No. 35 8"x24"—Hydraulic—latest type
MATTISON 12 x 14 x 48'—Hyd.—latest type
MATTISON 16x24x96—Hyd.—latest type
NORTON 6"x18"—Hydraulic—latest type
NORTON 10x60—Hydraulic—latest type
PRATT & WHITNEY 14x60 Hydraulic—latest type

● GRINDERS—Cylindrical plain and universal

BROWN & SHARPE No. 1, No. 2, No. 3, No. 4 Univ.; latest type
BROWN & SHARPE No. 5 Pl, 3x18—latest type
BROWN & SHARPE No. 23 Plain, 10x48—latest type
CINCINNATI 16 x 48 Pl.—latest type
LANDIS 12 x 64 Univ.—latest type
LANDIS 6 x 20 Pl.—latest type
LANDIS 4x12 Type H Plain Hydraulic—latest type
LANDIS 10x48 Type C Plain Hydraulic—latest type
NORTON 12x36 Univ.; Hyd.—latest type
NORTON 24x240 Plain—motor drive
NORTON 23x72 Plain—latest type

● GRINDERS—Internal, Cutter and Miscellaneous

BRYANT No. 5 Internal—chuck.—latest type
BRYANT No. 16—16" Hydraulic Internal
BROWN & SHARPE No. 13 Univ. & Tool—latest type
CINCINNATI No. 2 Plain Tool & Cutter—latest type
CINCINNATI No. 2 Centerless—M.D.
HEALD 72A3 Sizematic
HEALD No. 70—Internal—motor drive
HEALD No. 81 Plain Internal—latest type
LEBLOND No. 2 Universal Tool & Cutter; latest type
PRATT & WHITNEY Contour Cutter; latest type
OLIVER Univ. and Tool
OLIVER #510
UNIVERSAL Spline shaft; Hydraulic

● BORING MILLS—Horizontal

CINCINNATI-GILBERT 3½" bar; floor type latest type
FRANKLIN 4½" bar—SPD
GIDDINGS & LEWIS No. 25T 2½" bar—latest type
GIDDINGS & LEWIS #360F—6" bar Floor type
LUCAS No. 31—3" Bar, No. 33—4½" bar—motor drive
LUCAS No. 42—4" Bar—latest type
NILES BEMENT POND, 5" Bar—floor type
NILES BEMENT POND, 7" Bar—floor type
NILES BEMENT POND, 4½" Bar—Duplex
NILES BEMENT POND 5½" bar
NILES BEMENT POND 4½" bar—floor type
P & H #10—3½" bar floor type
UNIVERSAL 3" Bar—Timken Bearing—latest type
YODER #3—3" Bar—latest type—Timken Bearing

● BORING MILLS—Vertical

BETTS 120"—2-swivel heads, motor drive
BULLARD 2", 36", 42" New Era Type—motor drive
BULLARD 54" Spiral Drive; latest type
BULLARD 86"—2-swivel heads; motor drive
KING 72" 3-heads—latest type
KING 72" 2-swivel heads; motor drive
NILES BEMENT POND 84" 2-swvl. hds; M.D.
NILES BEMENT POND 120" 2-swivel heads; M.D.

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ALLEN #2, 2-4 spindles
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AVEY No. 2—3 spindles
AVEY No. 2—1 to 6 spindles
BAKER #121 Single spindle
BUFFALO #16—4 spindle
FOOTEBURTE SIPP #2, #3—single spindle
HENRY & WRIGHT—2-spindle
LELAND & GIFFORD No. 1—1 & 2 Spindles
NATCO No. 12 Multiple Spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. 1/2Bx50"—2-spindle deep hole—latest type

● DRILLS—Radial

AMERICAN 4'11", 5'11"—latest type
CARLTON 3'11"—latest type
WESTERN 4'18", 5'18", 620"—latest type

● GEAR CUTTING EQUIPMENT

BARBER COLMAN No. 3 Gear Hobber
BARBER COLMAN Type A
BROWN & SHARPE No. 13 Gear Cutter
BROWN & SHARPE No. 6x60 Gear Cutter
CINCINNATI Gear Burnisher
FELLOWS No. 7, No. 7A, No. 77 Gear Shapers
FELLOWS No. 624A Gear Shaper—latest type
GLEASON 3", 6", 11", 18", Bevel Gear Generators
GLEASON 12" Bevel Gear Gen.; latest type
GLEASON 10", 15" Spiral Bevel Finisher
GLEASON Bevel gear tester
GLEASON 24" Bevel Gear Planer
G & E No. 36B Gear Hobber
G & E No. 96H Gear Hobber, with differential

● LATHES—Turret

BARDONS & OLIVER No. 3—latest type
CINCINNATI-ACME 5W Timken Bearing—latest type
GISHOLT No. 2L Univ. Timken Bearing
GISHOLT No. 3, No. 4 Univ. Timken Bearing—latest type
JONES & LAMSON No. 3, No. 5, No. 7C
MOREY No. 2G, 1" Cap. Timken Bearing
MOREY No. 3 Univ.; 1 1/2" Cap. Timken Bearing
MOREY No. 4 Univ.; 2" Cap. Timken Bear.
WARNER & SWASEY No. 1A, No. 2A, No. 3A Univ., Timken Bearing—latest type
WARNER & SWASEY No. 3, No. 4, No. 5 Univ. Timken Bearing—Latest type

● LATHES—Engine & Mfg.

AMERICAN 24"x14'—Timken Bearing
BRADFORD 26" x 14"—Timken Bearing .....
HENDEY 14x6' bed, geared head—M.D.
HENDEY 14"x42" Centers; Timken Bearing—latest type
HENDEY 12x54 Centers, Mfg. Type
HENDEY No. 3x54 Centers Mfg. Type
LEBLOND 12x30 Centers Timken Bearing, Latest type
LEBLOND 18x54 Centers, Timken Bearing, Latest type
LEBLOND 16"x102" Centers, Timken Bearing—latest type
LEBLOND 21x16' Bed, geared head
LEBLOND 20" x 48'—20" x 120 centers—Timken Bearing—latest type rapid products
LODGE & SHIPLEY 16 x 30 Timken Bearing—latest type
LODGE & SHIPLEY 18x8' bed, geared head
LEBLOND 17x9' and 14' bed Timken Bearing Rapid Production
MONARCH 10x20 Centers, Model EE, Timken Bearing Latest type
MONARCH 14x30 Centers, Timken Bearing, latest type
LIBBY 1H-5 Timken Bearing—Latest type
MONARCH 16x54 Centers, Timken Bearing, latest type
MONARCH 30"x10' bed, Timken Bearing
NILES 36"x18' Timken Bearing
REED PRENTICE 14x30 Timken Bearing—Latest type
SOUTH BEND 16 x 6 Toolroom lathe
SENECA FALLS 8"x60" LoSwing Timken Bearing—Latest type

● PLANERS

CINCINNATI 24" Crank—motor drive
CINCINNATI 36x30x5' Box table, PRT, 1 head—motor drive
CINCINNATI 120x96x20'—4 heads box Table, PRT—motor drive
CLEVELAND 48x48x16' Open side, 3 heads, motor drive
DIETRICH & HARVEY 48x48x16' 4 heads, Hydraulic—Motor drive
GRAY 48x48x16' 4 heads Motor drive
HAMILTON 42x42x20', 4 heads, motor drive
LIBERTY 24 x 24 x 48'—latest Vari-voltage
LYND FARQUHAR 26" open side M.D.
NILES BEMENT POND 96x80x20' box table 4-heads Hyd. PRT. Motor drive

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CLEVELAND 7/8" to 2 1/2" Model A
CONO MATIC 3 1/2"—4 spindle—latest type

● PRESSES

CLEARING TYPE K-1200-30 Knuckle Joint, 200 Tons—latest type
CLEARING Type F-1100-36 Single Action 100 tons—latest type

● MISCELLANEOUS

CLEVELAND 12x16" Cutter Relieving Mach.
WATSON STILLMAN Hyd. Straightening Press 20 Ton
TREADWELL Pipe Threader 12"
MITTS & MERRILL No. 5 Keyseater
PEERLESS 6x6 Hack Saw—Auto. Feed
MARVEL No. 9, No. 9A Hack Saw
LUCAS #138 Old saw
LEBLOND #2 Deep Hole Borer
PRATT & WHITNEY No. 2A Jig Borer—latest type
MORTON 60" Combination Traveling head planer, milling & drilling
MOTCH & MERRYWEATHER #3 Cold Saw Hyd.—latest type

SPECIALS

MORTON boring, driling, milling and draw cutting traveling head planer 60" stroke

INGERSOLL 42 x 36 x 16' Plner Type Miller

PRATT & WHITNEY #2A Jig Borer—Ltest

MATTISON 16 x 24 x 96" High powered surface grinder

GOULD & EBERHARDT #96H Gear Hobber with Differential

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3' American Triple Purpose, m.d. on arm, 11" col.
3' American Sensitive, belt
3'-11" Carlton, m.d. on arm, latest
3' Fosdick Sensitive, belt
3'-9" Cincinnati-Bickford, m.d. on arm, latest
4' American Triple Geared, m.d.
4' No. 1 Bickford, gear box
4'-11" Carlton, m.d. on arm, latest
4'-13" American Hole Wizard, m.d. on arm, latest
4'-11" Cincinnati-Bickford, m.d.
4'-13" Cincinnati-Bickford, gear box
4' Fosdick, gear box
4' Niles-Bement-Pond, m.d.
5'-13" American Triple Geared, gear box
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Dreses—13" col., gear box
5' Prentice, m.d.
6'-15" American Triple, Purpose, m.d. on arm
6'-15" American Triple Purpose, m.d. on base
6'-17" American Hole Wizard, m.d. on arm, railroad type base, latest
6'-15" Carlton, gear box on base, double base
6' Cincinnati-Bickford Full Universal, gear box
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-15" American Triple Purpose, m.d. on arm
7'-15" Cincinnati-Bickford, m.d.
8'-16" American Triple Purpose, m.d. on arm
8'-16" American Triple Purpose, m.d. on base
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

24" Barnes All Geared Self-Oiling, belt
30" Rich H.D., m.d.
32" Aurora, belt
H3 Barnes Hydram, m.d.
No. 25 Foote-Burt, m.d.
No. 36HO Baker H.D., m.d., latest
D4 Colburn H.D., m.d.
D8 Colburn H.D., m.d.

SAWS

7½ H.P. Cincinnati Ice. Tool Co. type JCAW, Model 102 Abrasive Cut-off Machine
No. 3 Nutter & Barnes Cold Saw
No. 5, 6 Cochran-Bly Cold Saws
No. 11½ Rigley Cold Saws
No. 8 Nutter & Barnes Cold Saw
No. 138 Espen-Lucas Cold Saw

ROLLS

No. 3 Ajax Forging Rolls, m.d.
No. 4 Hilles & Jones Straightening Rolls, 8'-1" cap.

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Southwark Rotary Metal Cutter, cap. 3/8"
8' Niles-Bement-Pond Flanger
No. 2 Campbell Nibbler, m.d.

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10" Newton, cone
12" Bement-Niles, m.d.
15" Canada, m.d.
18" Dill, m.d.
48" Niles-Bement-Pond Geared, reversing m.d.

MISCELLANEOUS

Gisholt Precision Balancing Machine, m.d.
No. 2 Cochran-Bly Filing Machine
No. 12M Morey 2 spindle Profiler, m.d., latest
No. 12 Pratt & Whitney 2 spindle Profiler
Wagner Saw Sharpener, belt

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8"x108" Fitchburg Lo-Swing
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No. 2H Milwaukee Vertical, latest type
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No. 118 Van Norman Production
No. 27MB Smalley General Thread Miller
No. 6 Lees-Bradner Thread Miller
26"x25"x12' Ingersoll Adjustable Rail
42"x36"18' Ingersoll Adjustable Rail, four heads

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42" Bullard New Era Vertical Turret
72" Colburn, Motor Drive

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No. 50 Universal, 5" Bar, 60"x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".
No. 32 Lucas, 3¾" Bar

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No. 4 Pfauter, 72" Capacity

PLANERS

36"x36"x8' Woodward & Powell
60"x38"x8' Gray Spiral Geared

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No. 3 Warner & Swasey Univ., Auto. Chuck & Bar Feed, (1943) 6 in stock
No. 4, No. 6 Warner & Swasey
No. 1-A Warner & Swasey, Timken Brg., Covered Ways
6.2" Denver, chucking machine
No. 6R Denver Univ., 2-9/16" capacity
18" Libby, 3½" Hole in Spindle
No. 2 American Brass Lathe

AUTOMATICS

1⅝" Conomatic, 8 spdl.

GRINDERS

10"x24" Landis Universal Grinder
No. 72 Heald Internal Grinder
Oliver Ace Univ. Tool & Cutter Grinder

HILL-CLARK
MODERNIZED & MOTORIZED CYLINDRICAL GRINDERS

SIZES AVAILABLE

10 x 18	14 x 36	16 x 50
10 x 36	14 x 50	16 x 72
10 x 50	14 x 72	18 x 96
10 x 72	14 x 96	24 x 96
10 x 96		24 x 240

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AUTOMATICS

⅝"-⅞" x 8" Cleveland Model B
1⅝" x 7" New Britain 6 spindle
2" x 8" Cleveland Model B
6" x 6¾" Goss & DeLeeuw 4 spindle
No. 454 New Britain 4 spindle chucker
No. 16 Gisholt Simplimatic

BORING MILLS

96" Cincinnati Massive Pattern
61" Bullard Maximill
60" Colburn—42" Bullard V. T. L.
3½" bar Lucas horizontal
3½" bar Universal horizontal

GEAR MACHINERY

Nos. 3 & 12 Barber Colman hobbers
Nos. 7 & 61 Fellows shapers
11" Gleason bevel generator
18" Gleason testers & lappers
No. 3 Barber Colman hob grinder
Nos. 12H, 16HS & 18H G&E hobbers
8"-10" No. 1 Lees Bradner
14"-8" No. 5A Lees Bradner
24" x 12" Flather—64" x 20" G&E
36" x 6" G&E spur cutter
48" x 10" No. 4 Brown & Sharpe
8" Red Ring lapper
No. 4 Cimatool Peerless gear rounders

GRINDERS

6" x 18" Norton hydraulic
6" x 18" Landis Type C hydraulic
6" x 20" No. 10 B&S Elec. hydraulic
6" x 20" Cincinnati hydraulic
12" x 36", 16" x 36" & 16" x 72" Landis
10" x 18", 10" x 36" & 10" x 50" Norton
10" x 36" No. 2 Bath univ.
18" No. 6 Besly type I opposed spindle
36", No. 18 Blanchard surface
16", No. 10 Blanchard surface
14" Pratt & Whitney vert. surface
6" x 18", No. 2 B. & S. surface
No. 2 Brown & Sharpe universal
No. 104 Rivett internal
No. 72A3 Heald Sizematic internal
No. 75A Heald, cross feeding head
No. 3 Barber Colman hob grinder
20", No. 120A Gardner opposed disc
No. 2 Cincinnati centerless

LATHES

36" x 16' Bridgeford geared head
14" x 6' & 16" x 6' American grd. hd.
16" x 6' & 18" x 8' American cone
14" x 6' Hendey grd. hd. toolroom
14" x 6' Mulliner
17" x 6' Leblond grd. hd. Mfg.
14" x 18" Monarch Magnamatic
14" x 19" Fay automatic
8" & 15" Sundstrand automatic stub
8" & 12" Sundstrand stub

MILLERS

OY Brown & Sharpe
Nos. 2B & 3B Milwaukee Plain
No. 3S Cincinnati Plain
No. 35 Ohio universal
No. 2 Brown & Sharpe vertical
No. 2½B Milwaukee vertical
No. 4—36 Cincinnati Hydromatic
30" & 48" Newton rotary
30", 42" & 48" Ingersoll rotary
No. 12B Pratt & Whitney profiler
No. CT36 Lees Bradner thread
Type C Hall planetary thread

SHAPERS & PLANERS

32" Morton draw cut shaper
30" x 30" x 12' Cleveland openside
32" x 32" x 8' Cincinnati planer

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BORING MILLS

3" Bar Universal TRI-WAY Horizontal, Power Rapid traverse, M.D.
72" COLBURN, two swivel heads, all geared power feeds, M.D.
73" NILES-BEMENT-POND, two swivel heads, all geared power feeds, M.D.
84" CINCINNATI Rapid Production Type, one swivel head, one turret head
96" CINCINNATI Rapid Production Type, two swivel heads, M.D.
100" NILES-BEMENT-POND, two swivel heads, all geared feeds, M.D.
120" BETTS Heavy, two swivel heads, all geared feeds, power rapid traverse.
10/16' CINCINNATI Massive Pattern, two swivel heads and extension boring head.
14'-20' NILES-BEMENT-POND Extension type, 2-swivel heads, all geared feeds, table 144"x12"

MILLERS

42"x26"x12' INGERSOLL Planer Miller, 4 heads, M.D.

No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½"x64". Single pulley belt drive or AC or DC.
Nos. 2, 3 and 4 CINCINNATI High Power Vertical adjustable head, P.R.T.
No. 5 CINCINNATI Plain Rectangular overarm, table overall 21"x83".

LATHES

30"x18' LODGE & SHIPLEY Selective geared head, taper attachment.
42" x 36" PUTNAM Geared Head 24' between centers. Quick change gear box.
#3 NILES-BEMENT-POND, axle lathe, M.D.
42" PUTNAM Car Wheel, M.D.
79" NILES-BEMENT-POND Driving Wheel, M.D.
60"x48' N-B-P Geared Head

RADIAL DRILLS

5⅛' AMERICAN Full Universal Triple Geared Tapping Atachment.
6' AMERICAN Triple purpose, plain radial, motor on arm.

PLANERS

48" x 48" x 15' NILES-BEMENT-POND four heads, 230 volt, D.C. reversing type planer motor and control.

72" x 72" x 15' N-B-P Heavy 4 heads, double deck table. 230V. DC Reversing.
120"x96"x20' CINCINNATI 4-heads, 230 volt D.C. Reversing Motor Drive.

GEAR HOBBER

100" GOULD AND EBERHARDT Horizontal for spur, helical and worm gears. Max. capacity 101" diameter. 48" face. Forced feed lubrication.

SLOTTERS

6" & 10" PRATT & WHITNEY Vertical Shaper with rotary table, power feeds, tilting ram. AC or DC motor drive.
14" STEPTOE Crank Shaper.
15" NEWTON Crank Slotter, 30" circular table AC or DC.
16" SPRINGFIELD Crank Shaper.
22" N-B-P Crank Slotter.

MISCELLANEOUS

30' No. 3 HILLES & JONES Plate Edge Planer.
30'x⅞" NBP Bending Rolls, pyramid type.
No. 2 PRATT & WHITNEY Jig Borer with 22"x44" table.
5" Capacity Alligator Shear, M.D.
60" NEWTON Cold Saw M.D.
26"x10' Libby Turret Lathe

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BORING MILLS

3" Bar Universal, Horizontal.
No. 25 RT Giddings & Lewis, Horizontal.

DRILLS

21" Superior, Sliding Head.
28" Cincinnati Bickford, Sliding Head.
32" Cincinnati Bickford, Sliding Head.
42" Bickford, Radial.
6' American, Radial.

LATHES

2-16"x30" Monarch with Keller Attachments.
19"x8' Sidney.
30"x20' Lodge & Shipley, Geared Head.
31"x21' American, Geared Head.

MILLERS

No. 2 B. & S., Plain, Double Overarm.
No. 2 Cincinnati, Vertical, Dial Type.
No. 2 Cincinnati, Universal.

TURRET

No. 3B Foster, Universal.

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LATHES—TURRET

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BARDONS & OLIVER #7 Univ.; Timken Bearing; chucking
WARNER & SWASEY #4A Timken Bearing

LATHES—BORING

NILES 30"x50
NILES 30"x46'

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FOX #8 Swing Frame

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Acme 3¼" M.D.
No. 1L Gisholt Univ. M.D.

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Blanchard 30", M.D.; Modern 12x48" M.D.
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Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
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B. & S. No. 10 1' Cyl.
No. 2 Cincinnati Centerless, M.D.
B. & S. No. 1, 3 Universal
#25, #35 G. & L. M.D.

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14"x6', 16"x6' Hendey Grd. Hd.
9" LeBlond Automatic
36x30' Putnam, M.D.
36x22" Putnam, S.C.G., D.C.M.D.
32"x36' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
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B. & S. No. 00, 0
5 Spdle. Davenport 9/16" cap.
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Cleveland Model B 1", 2"
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Providence Planer Type 32"x8'
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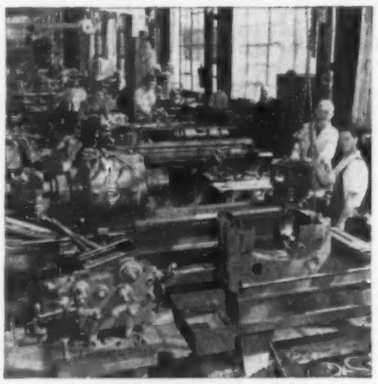

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Grinder, Leach 7x11, M.D.
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No. 11 Natco Multiple Drill, 16 spindle.
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Gear cutter, Gould & Eberhardt 42"
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GRINDERS, Landis Hydraulic, 6"x18". M.D.
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American 70' Span
American 47'4" Span
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P & H 87'6" Span
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P & H 60' Span
Morgan 30' Span
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1—3A Warner & Swasey
1—1A Warner & Swasey
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1—3 Spindle Allen 8" High Speed #2 Morse Taper

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2—1"x18" Pratt & Whitney Automatic
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1—30" Pratt & Whitney Profiler. Single spindle. M.D., Late type.

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Lathe, Turret 3-A W. & S. S.P.D.
Press, Forging 1000 Ton United St.-Hyd.
Planer, 30"x36"x12' Powell 4 Hds.
Planer, O. S. 60"x60"x14' D. & H., M.D.
Profiler, #13 P. & W., B.D.
Shapers, 10"-20"-24"-60".
Shaper, 36" Morton Draw Cut

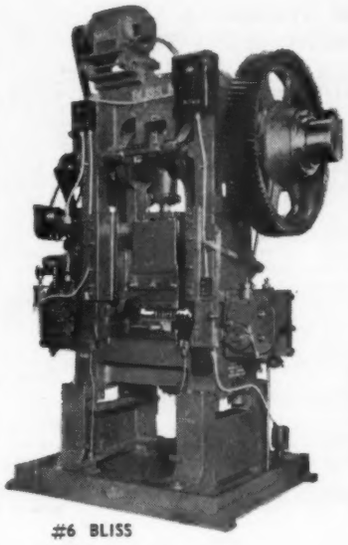
West Penn Machinery Company
1210 House Bldg. Pittsburgh, Pa.

FOR SALE — MILLING MACHINE

Four head Frew automatic milling machine for producing open end slots or spline milled openings, complete with electrical equipment. Will take end mills up to ½" shank. Capacity 1000 pieces per hour. Excellent condition. Contact P. Keppeler,

JAS. P. MARSH CORP.
2073 SOUTHPORT AVE., CHICAGO 14, ILL.

NEW—USED MACHINERY and EQUIPMENT
LARGE STOCK ON HAND
Hasco MACHINERY COMPANY
641-671 FRELINGHUYSEN AVE.
NEWARK 3, N. J. BIGELOW 3-3484-7



#6 BLISS

TREMENDOUS STOCK AT REDUCED PRICES

LATHES

60" & 38" swing x 23' McCabe Double Spindle, M.D.
60"x32' Niles-Bement-Pond. G.H. Q.C. M.D.
50"x26' Johnsen G.H. M.D
48"x24' Blocked to 80" Fifield. D.B.G.
37"x18' Bridgeford. G.H. Q.C. M.D.
36"x14' Niles. Q.C. G.H. M.D.
16"x6' Monarch. M.D. Late type
Many others from 7" to 98" swing. Niles, Lodge & Shipley, American, Monarch, Hendey, Leblond, South Bend, Logan, etc.

TURRET LATHES

#5 Midland. M.D.
#4 Gisholt. M.D.
#2, #3, #4, #5, #1A, #2A, #3A Warner & Swasey
#1, #2 Foster
Many others from ⅝" to 6" capacity.

PLANERS

72"x72"x26' Sellers, 4 heads. M.D.
60"x60"x12' Pond. 4 heads. M.D.
48"x48"x10' Cincinnati. 4 heads. M.D.
36"x36"x12' Niles-Bement-Pond. 2 heads. M.D.
42"x42"x12' Pond. 4 heads. M.D.
36"x36"x8' Powell. 2 heads. M.D.
120"x25' and 36"x18' Dietrich & Harvey. Open side. M.D.

BORING MILLS

3½", 4", 5", 6" Horiz. Universal, Sellers, Ohio, Lucas, Niles, Defiance.
24" to 10' Vertical Bullard, Niles, Cincinnati, Betts, Colburn, etc.

SHAPERS

7" to 32" Rhodes, Smith & Mills, Gould & Eberhardt, Stockbridge, Walcott, etc.

MILLERS

#2, #3, #4, #5 Plain and Universal. M.D. Cincinnati, Brown & Sharpe, Milwaukee, Hendey, Van Norman.
#2, #3, #4, #5 Vertical. M.D. Brown & Sharpe, Cincinnati, Bridgeport, Baker.
#08 Cincinnati, Vertical, M.D.
Brown & Sharpe, Cincinnati and Briggs Production, M.D.

AUTOMATICS

#00, #2 Brown & Sharpe
2", 2½", 2¾" Cleveland, M.D.
Gridleys, Aemes, New Britains—latest models.

PUNCH & SHEARS

Cincinnati, Adlerhurst, Press Rite, Quickworth, etc.

GRINDERS

Cylindrical, Plain and Universal. Landis, Norton, Brown & Sharpe, Cincinnati.
22"x72" Lempco Crankshaft. Late type.
Blanchard, Brown & Sharpe, Reid, Covel, Thompson, Sanford, Pratt & Whitney—Surface
#2 and #3 Cincinnati Centerless
Brown & Sharpe, Gallmeyer & Livingston, Cincinnati—Universal Tool & Cutter
#70 Heald Internal, M.D.

HAMMERS, PRESSES AND OTHER FORGING EQUIPMENT

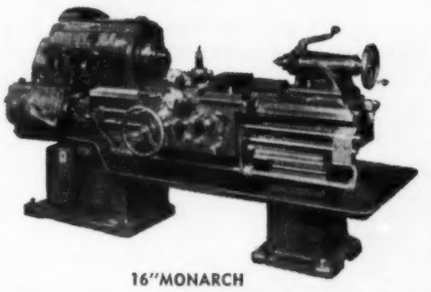
¼" to 8" Upsetters. Ajax, Waterbury
Hydraulic Presses. 60 to 3000 tons. Watson-Stillman, HPM, Farnham, Oil Gear Co., etc.
Mechanical Power Presses, up to 2000 tons. Ferracute, Toledo, Bliss, Waterbury, Z & H, V & O, etc.
#60¼ Toledo Power Press, 1200 ton
#57 Toledo Press, 100 ton
#89, #88, #78½, #39½, #27, #26A, #6 Bliss Presses
Steam Hammers from 100 lbs. to 35,000 lbs. Erie, Chambersburg, Niles, etc.

MISCELLANEOUS

Gear Cutters
Bliss, Rafter, Ryerson, Hilles & Jones Rolls
#40 Waterbury-Farrell Thread Rollers
Saws
Many other special machines

THIS IS A PARTIAL LIST—Complete plants for sale or installed. Terms arranged.

S & S MACHINERY COMPANY
207 CENTRE STREET NEW YORK 13, N. Y.
MDNA MEMBER



16"MONARCH

THREAD GAGES—PLUG AND RING

Slightly used, NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.
LESS 75 Percent Discount.

ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".
LESS 75 Percent Discount.

DE WITT TOOL COMPANY
173 GRAND STREET NEW YORK 13, N. Y.
Send For Our Bargain Circular

McDONALD
USED MACHINERY

G & E & Davis 16" Shapers
Cleveland O.S. Planer 36"x8', 2 hds.
American 4' Radial Drill, encl. hd.
Cincinnati D. H. Planer 36"x36"x10', 2 hds.
Barnes geared Camelback Drill Press, 4 sp.
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Lucas #32 Horiz. Boring Mill & Univ. #3-A
L & S 18 x 12' & 20' x 10' 20" x 8' Grd. Hd. M.D. Lathes
American 24" x 12' grd. hd. lathe, m.d. q.c.g.
Amer. 4-ton vert. Hydr. Broach.
Blanchard Vert. Surf. Grinder, 26 rd. chuck.
Cincinnati #2 Centerless Grinder.
Diamond Horiz. Surf. Grinder, 12"x60" Table.
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No. 5 H.P. grd. hd. S.P.D. Pl. Miller.
Milwaukee No 3-B Vert. Miller grd. hd., m.d.
Cin-Bick 3' Super Serv. Radial
Cincinnati 48" Auto Pl. Prod. Miller, S.P.D.
W.&S. No. 2A grd. hd. Univ. Turret Lathe, S.P.D.
Foster No. 2F Fastermatic grd. hd. Turret Lathe, M.D.

MDNA MEMBER

McDONALD MACHINERY CO.
1531-35 N. B'way., St. Louis 6, Mo.

SHEET METAL MACHINERY

NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders

MDNA MEMBER

B. D. BROOKS, INC.
361 Atlantic Ave., Boston, Mass.

DRILL RADIAL—FOSDICK 3½", G.B., M.D.
KEYSEATER—MITTS & MERRILL No. 6, M.D.
MILLER, PLAIN—MILWAUKEE No. 2-B Double Over-arm, M.D.
PLANER, METAL—WOODWARD & POWELL 30"x30"x8'; 1 rail head, 1 side head.
TURRET LATHES—FOSTER No. 1-B Univ. inc. 2 Wrenches, Chucks, etc. M.D.; also W & S No. 2-A, Univ.
Available immediately—Also Many Other Tools
ALEX ZEEVE & COMPANY
2269 Woolworth Bldg. New York 7, N. Y.

ALWAYS A SOURCE OF SUPPLY

For Machine Tools, Stamping Presses, Structural Machinery, Forging Equipment, Hydraulic Equipment, Air Compressors, Production Equipment.

OUR SERVICES ARE ALWAYS AT YOUR DISPOSAL

EMERMAN MACHINERY CORP.
875 W. 120th STREET CHICAGO 43, ILLINOIS

American grd. hd. lathe, m.d., 30" swing x 60" centers.

16"x8' Lodge & Shipley lathe, grd. hd., motor in base.

14"x8' Hendey grd. hd. lathe, m.d.

#0 Giddings & Lewis horiz. borer, m.d.

6" Pratt & Whitney vertical shaper, m.d.

6"x72" Pratt & Whitney thread miller, m.d.

6"x48" Pratt & Whitney thread miller, m.d.

24" Cincinnati "Super Service" drill press.

#2b Milwaukee horiz. miller, grd. hd., m.d.

#3b Milwaukee horiz. miller, grd. hd., m.d.

30"x30"x8' Putnam planer, motor drive.

30"x30"x8' Detrick & Harvey openside planer, m.d.

#4 Mitts & Merrell keyseating machine

36" Fosdick radial drill, grd. hd., m.d.

MICKLEBURGH
117 N. 14th Sreet
PHILADELPHIA 6, PENNSYLVANIA
Lombard 5044

FOR SALE REASONABLY PRICED

LIST #202—JUNE 1, 1946—NEW STAINLESS STEEL SHEETS—COLD ROLLED—2D FINISH—SOFT TEMPER

Item No.	Approx. Quantity	Gauge		Size	Type and Description
1	* 31000#	.006"	(34 ga.)	32"x72"	Type 302
2	40120#	.078"	(14 ga.)	34"x118"	Type 316
3	2288#	.078"	(14 ga.)	29"x36"	Type 316
4	1150#	.078"	(14 ga.)	34"x100"	Type 316
5	3293#	.078"	(14 ga.)	34"x100"	Type 316
6	1300#	.078"	(14 ga.)	24"x94"	Type 316
7	28345#	.062"	(16 ga.)	22"x100"	Type 316
8	9466#	.032"	(22 ga.)	25"x108"	Type 316
9	2688#	.032"	(22 ga.)	25"x144"	Type 316
10	72#	.032"	(22 ga.)	30"x84"	Type 316
11	4644#	.032"	(22 ga.)	30"x90"	Type 316
12	605#	.010"	(32 ga.)	12"x120"	Type 316
13	488#	.0625"	(16 ga.)	36"x96"	Type 347
14	714#	.0625"	(16 ga.)	48"x120"	Type 347
15	1860#	.032"	(22 ga.)	36"x96"	Type 347
16	930#	.032"	(22 ga.)	36"x96"	Type 347
17	2062#	.018"	(26 ga.)	18"x120"	Type 347
18	2880#	.015"	(29 ga.)	18"x120"	Type 347
19	630#	.014"	(29 ga.)	18"x120"	Type 347

* Item 1 is only item ¼ Hard.

PLATES—HOT ROLLED—ANNEALED—PICKLED

20	235#	.312"	31"x78"	Type 321
21	200#	.312"	30"x70"	Type 321
22	220#	.312"	31"x72"	Type 321
23	230#	.312"	31"x79"	Type 321
24	210#	.312"	29"x80"	Type 321
25	380#	.312"	34"x106"	Type 321
26	360#	.312"	37"x100"	Type 321
27	340#	.312"	37"x98"	Type 321
28	1310#	.312"	35"x72"	Type 321

STRIPS

Item No.	Approx. Quantity	Gauge	Size	Type and Description
29	303#	.055"	1-3/16" x Coil	Type 302 ¼ Hard, CR, 2B Finish
30	416#	.055"	1-1/16" x Coil	
31	500#	.050"	7" x Coil	Type 302, CR, Soft, Commercially Pickled.
32	2875#	.187"	25½" x Coil	Type 302, CR, ¼ Hard, Annealed and Pickled, 2B Finish
33	3156#	.156"	14½" x Coil	
34	3268#	.156"	14⅜" x Coil	
35	2748#	.1379"	17" x Coil	Type 310, HR, Annealed and Pickled
36	22502#	.017"	1" x Coils	Type 321, Soft, CR, 2D Finish
37	1282#	.050"	21½" x Coil	Type 321, Soft.
38	3850#	.049"	27½" x Coil	Type 347, CR, Medium Soft, Dull Finish
39	12100#	.140"	24" x Coils (6)	Type 347, HR,
40	5780#	.060"	23" x Coil	Annealed and Pickled
41	18175#	.060"	8-3/16" x Coil	Type 347, CR, Hard, Bright Finish
42	213#	.120"	27/64" x Coil	Type 410, Soft to ¼ Hard, Annealed, CR

WRITE — WIRE — PHONE

DULIEN STEEL PRODUCTS, INC.
2280 Woolworth Building COrtlandt 7-4676 New York 7, N. Y.

2000# Steam Drop Hammer—Can Show Running

800# 1000# 2500# 4000# 5000# Board Drop

90" 9-Roll Leveller and Straightener 1½" Cap. M.D.

16 Ft. x 1½ Leveller and Straightener M.D. 7-Roll

26 Ft. Plate Planer—M.D. Hydraulic Holddown

2—Wagner 38" Cold Saws M.D.

H. J. KOONTZ
MASSILLON, OHIO Phone 8180

SURPLUS MACHINERY LIQUIDATION

Automatic Screw Machines
Two ⅝" RA 6 National Acme
Two 1⅜" RA 6 National Acme
Three Model 61—1⅜" New Britain Gridley Bar Feed
Four Model 61—1⅜" New Britain Gridley equipped for second operation
Two Model 43 four spindle 1⅜" New Britain Gridley

LATHES
Two 36" x 7' Sidney Lathes 1942
American 30" x 15'
New Haven 48" x 18'
Reed Prentice 24" x 6'
Reed Prentice 24" x 2' taper attach, geared head quick change, chuck face plate, new in 1942

Spray Booths
Degreasers
Burnishing Barrels
DRILL PRESSES
Single to four spindle with Production tables floor and bench models

Six Universal Detroit Duplicators
Landis Threaders
Lepel Induction 30 K. W. Heater
Barrett chip separators with oil purefiers controls pump tanks
Binks Pressure Paint Tanks
Tapping machines
Cleveland, Haskins, Thompson Gibb Spot Welders
Buffing stands
Lees Bradner Thread welders model 40-L. A.

LOCKERS

Pans
Baskets
#2 Bakewell Tapping Machine new 1943
B-6 Porter cable Sander (120" x 3" belt) serial #751-2 H.P. motor
Ingersoll Rand compressor
Campbell abrasive cut off machine model #213 Bar type
Hill Clarke cylindrical Grinder 96" centers new 1942

OTHER ITEMS—SEND FOR OUR LIST

R. V. OSMUN CO.
406 BLOOMFIELD AVENUE BLOOMFIELD, N. J.
BLFD. 2-7640
Liquidators for CONGOLEUM NAIRN CO.—Surplus Equipment

FOR SALE

Two exceptional machine tool buys in operating condition.

NATCO C13 32 spindle Multiple Drill Press; 7½ hp motor, 220 v., 3 ph.; #1 taper spindles with six speeds; coolant system, additional small spindles, arms, etc.; condition very good.

GOULD & EBERHARDT 36BM Bevel and Spur Gear Cutter; motorized; 220 v., 3 ph.; 3 spindles to 12" diameter; 1 spindle to 36" diameter; change gears, etc.; condition good.

MAN-SEW CORP.
121 W. 27th St. New York 1, N. Y.

QUALITY MACHINES
2—0" Nat-Acme Chuskers., 8-spindles. (1940)
2—#2-SU. Van Norman Universal Millers. (1940)
1—No. 1½ Knight Vert. Miller, P.F., for MD.
1—2 HP. U. S. Flexible Shaft Grinder, 3/60/440. (New)
IMMEDIATE DELIVERY
GALBREATH MACHINERY CO.
EMPIRE BUILDING PITTSBURGH, PA.

POWER PRESSES

No. 96A Toledo Double Crank Bed 44x48"

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

"SEARCHLIGHT"
Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

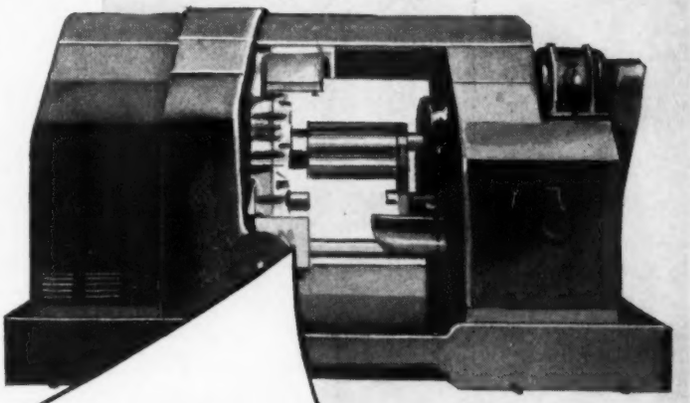
Take advantage of it—For Every Business Want
"Think SEARCHLIGHT First"

CIAL LATHE BUYS!

TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
Heavy Duty Mfg. and Prod. Multi-tool, not automatic	Up to 20" swing	788
Single Spindle, Horizontal, Platten type		63
Single Spindle, Horizontal, Turret type		280
Multi Spindle, Horizontal	4 to 8 Spindles	1,518
Multi Spindle, Vertical	6 to 8 Spindles	202
Auto. between centers chucking, horiz. single spindle	All sizes	2,036
Speed Lathes	1/6 to 5 HP	2,070
Turret Lathes	All sizes	144

(D) Multiple Spindle Horizontal Lathes

These 4, 5, 6 and 8 spindle machines or equivalent (see table) are located in Chicago, Cleveland, Detroit, Nashville and St. Louis offices of War Assets Administration. Ask any W. A. A. office.



GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

LATHES

An immediate source of additional or more modern production equipment is the large inventories held by the War Assets Administration. Built for war, basic machine tools such as these lathes are ready to serve in peace. Hundreds of items are available now, priced for quick sale. You can do yourself and America an important service by putting this idle production capacity to work as quickly as possible. Check this and the following three pages carefully and act at once to secure equipment you can use profitably.

Heavy Duty Mfg. and d. Multi-tool Lathe (not matic). These heavy duty uction tools are available in ntity in Detroit, Chicago, on, and New Orleans offices ar Assets Administration. For is contact any W. A. A. office.

erans of World War II— elp you in purchasing surplus erty, veterans' units have established in each War s Administration Regional e.

MAIL TODAY*

To War Assets Administration:

Please send me information on the types of lathes checked at the right. I am also interested in the availability of the following types of lathes not listed in this advertisement:

.....

.....

.....

Name.....Telephone No.....

Firm.....

Address.....

City.....State.....

*For War Assets Administration address, see 4th page of this advertisement.

277-4

LATHE CHECK LIST

(These key letters correspond to the machines listed in the table above. Simply check those in which you are interested.)

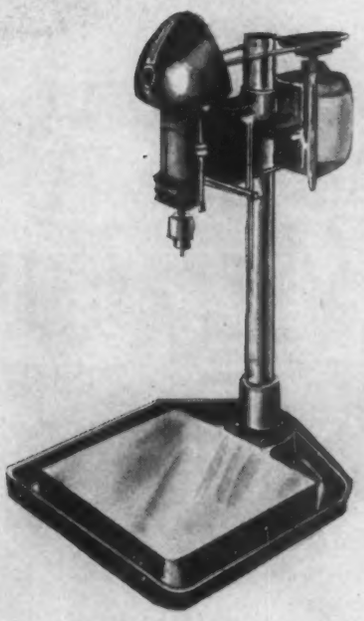
Ⓐ___ Ⓑ___

Ⓒ___ Ⓓ___

Ⓔ___ Ⓕ___

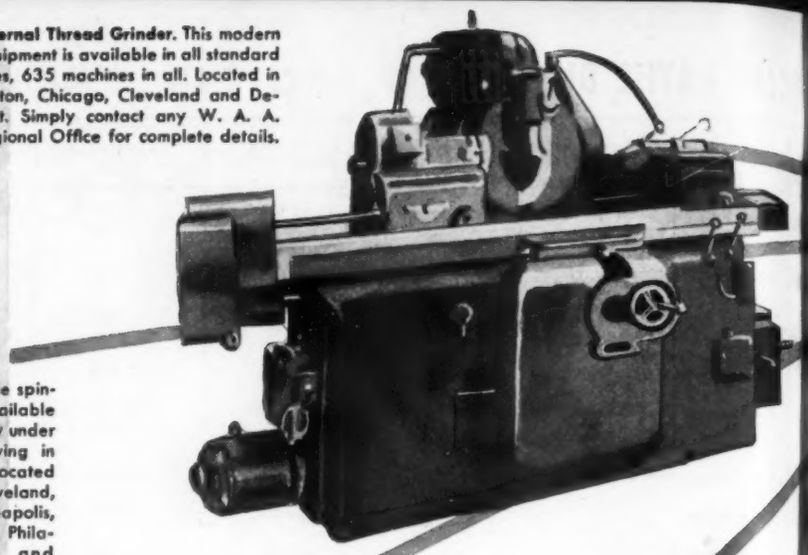
Ⓖ___ Ⓗ___

277-4

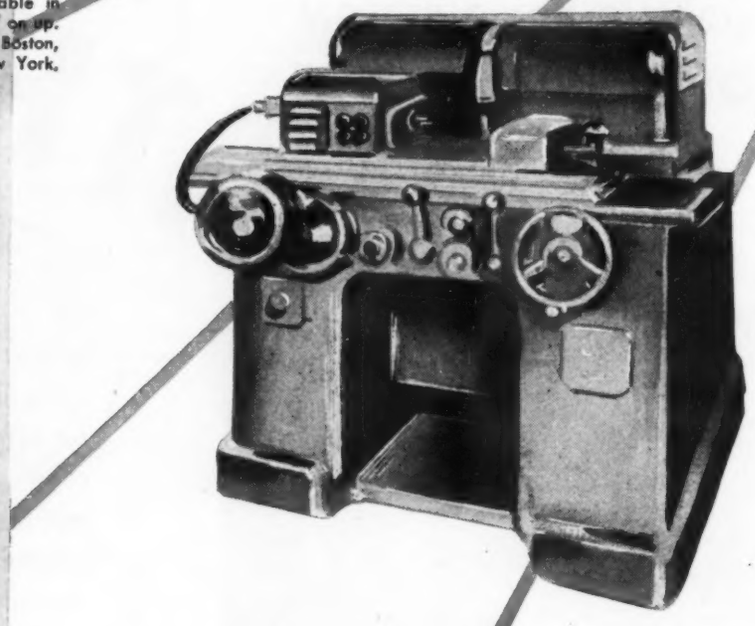


Bench Drill. Sensitive, single spindle, round column type; available up to 22" swing in capacity under ½"; from 16" to 24" swing in capacity from ½" to 1". Located in Boston, Birmingham, Cleveland, Charlotte, Detroit, Minneapolis, New York, Oklahoma City, Philadelphia, San Antonio and St. Louis Regional Offices.

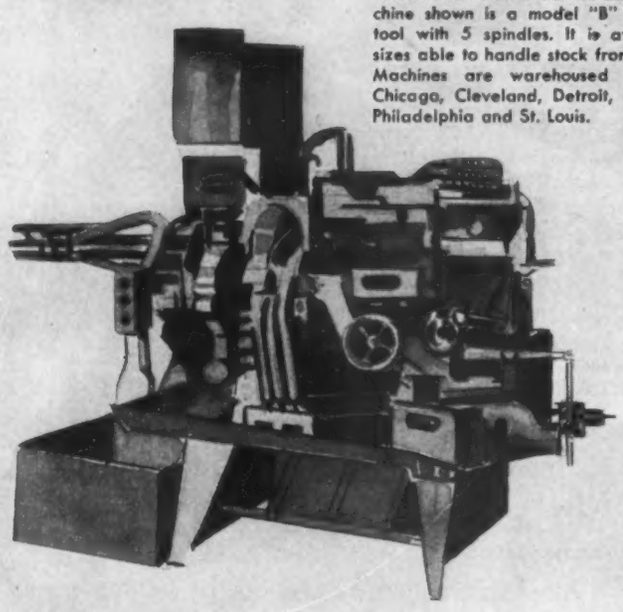
External Thread Grinder. This modern equipment is available in all standard sizes, 635 machines in all. Located in Boston, Chicago, Cleveland and Detroit. Simply contact any W. A. A. Regional Office for complete details.

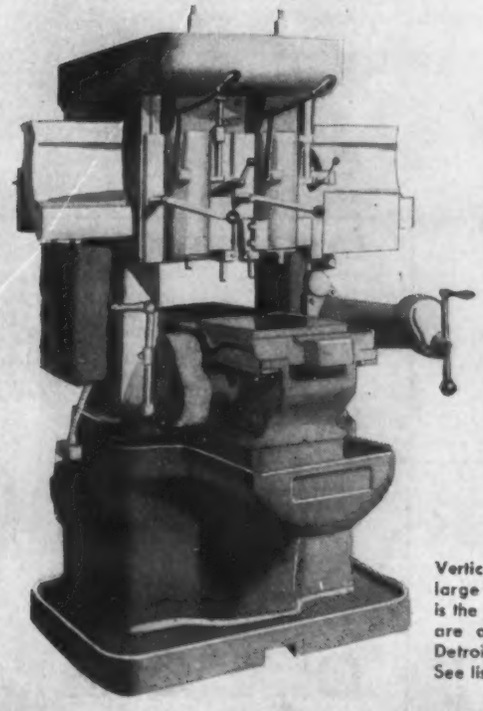


External Cylinder Grinder—Plain. This is a Norton model but other makes are also available. Total inventories in Boston, Chicago, Cleveland, Detroit, Philadelphia and St. Louis amount to 1730 machines.

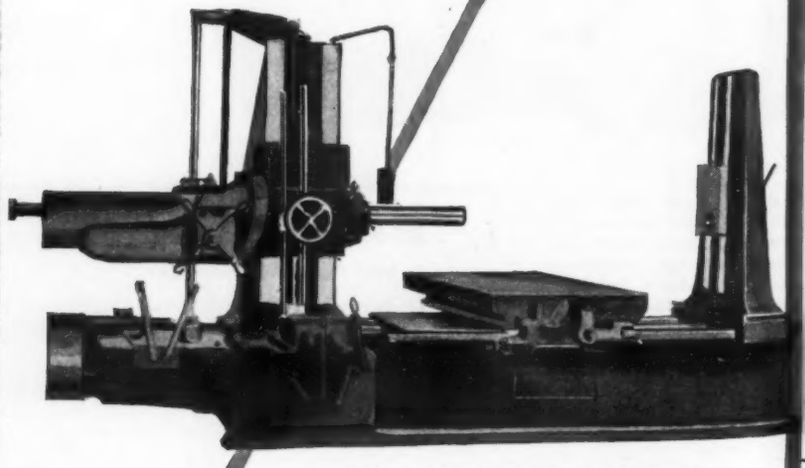


Automatic Screw Machine-Bar. The machine shown is a model "B" Davenport tool with 5 spindles. It is available in sizes able to handle stock from 1" on up. Machines are warehoused in Boston, Chicago, Cleveland, Detroit, New York, Philadelphia and St. Louis.





Vertical Profiler—2 spindle type. Typical of a large number of 1, 2, 3, and 4 spindle machines is the milling machine shown here. These machines are available in Boston, Chicago, Cleveland, Detroit, New York and other Regional Offices. See list (next page) for other types also in stock.



Horizontal Boring, Drilling and Milling Machines. Here is another illustration of a machine typical of an entire class of machine tools available in large quantity at many W. A. A. Regional Offices, in standard makes and sizes.

BASIC TOOLS

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

(second in a series of 4-page advertisements designed to inform industry of available machine tool surpluses)

Here, by the hundreds, are the tools you need to modernize your production and establish new enterprises—available *now* at low cost—at a time when a war-devastated world is exerting the biggest demand for goods and services ever known. You owe it to yourself, your organization, and your fellow men to put this productive capacity to immediate use. So check this list carefully. Find out which of these basic tools will help you solve immediate production problems. Then clip and mail the expediting coupon to the nearest War Assets Administration office listed on the next page. War Assets Administration is a government agency specially created to help you apply War Surpluses to post war needs.

CHECK LIST OF SPECIAL MACHINE TOOL BUYS!

Here are a few of the many thousands of machine tools now available through War Assets Administration.

KEY*	MACHINE (function)	TYPE	SIZE OR CAPACITY	Quantity Available Now
A—	Grinders	Race Radius—External		118
B—		Race Radius—Internal		72
C—		Contour Profile		75
D—	Screw Machine	Auto—Bar—Single Spindle	Up to 1½" cap.	1975
E—	Screw Machine	Auto—Bar—Five Spindles	All sizes	1515
F—	Screw Machine	Auto—Bar—Eight Spindles	1½" and Over cap.	380
G—	Engravers	Pantograph—2 Dimensions		70
H—	Honers	Internal—Horizontal	Under 6" Bore	175
I—		Internal—Vertical		129
J—	Lapping	Flat Surface Only	24" Diam. lap plate	107
K—	Polishers & Buffers	Floor Type	½ to 10 H.P.	1479
L—	Lathes	Speed Type	Up to 3 H.P.	1490
M—	Saws	Circular Cut-off		250
N—	Abrasive Machine	Belt Drum & Disc		580
O—	Abrasive Cut-off			112
P—	Tapping	Vertical—1 & 2 Spindle		457
Q—	Tapping	Horizontal—1 Spindle		259
R—	Die Threading	Bolt Rotary—1 Spindle		390
S—	Centering	Double End—Horizontal		112
T—	Pointing, Chamfering & Burring			141
ZZ—	Gear Shapers	External & Internal	Up to 40" Diam.	
PP—		Spur—External only		
QQ—		Spur & Helical—External & Inte		
RR—		Spur & Helical—External only		
SS—	Gear Cutters	Bevel Type not inc		
TT—	Gear Tooth Finisher	Plainer Type Str. B		
UU—		Generating Type Grinding		
VV—	Gear Tooth Lapper	Formed Wheel Type External only		
WW—	Gear Tooth Shaver	Comb. External & Internal		
XX—	Grinder	Rotary Type		
		External Cylinder—Plain		

KEY*	MACHINE (Function)	TYPE	SIZE OR CAPACITY	Quantity Available Now
U—	Shaver	(Not Gear)		104
V—	Reamer	(Not Rifle)		516
W—	Drawing Machine		100,000# and over	21
X—	Machinery & Equipment Allied to Primary Metal Forming Machine and Equipment			
		Pickling	All sizes	149
Y—	Straight Side Presses	Vertical—Single Action	5 to 100 Tons	165
Z—		Vertical—DoubleAction	5 to 100 Tons	111
AA—	Flame Cutting Machine			1631
BB—	Hardness Tester	Brinell—Portable & Power		200
CC—		Rockwell—Manual & Power		425
DD—	Inspection Machine	Magnetic (Magnaflux)		601
EE—	Balancing Machine	Static		93
FF—		Dynamic		67
GG—	Boring, Drilling & Milling			
		Horizontal	Under 3" to 6"	209
HH—	Boring & Turning Drills	Vertical	Under36"to120"Swing	683
II—	Boring Fixed Rail Tank Mill	Vertical		87
JJ—	Precision Boring Machines	Horizontal bridge—single end	Under 8" to 14"	486
KK—		Horizontal bridge—double end	Under 8" to 14"	226
LL—	Drills	Box column—single spindle	Under ½" Cap. Up to 22" Swing ½" to 1" Cap. 16" to 24" Swing	287
MM—				
NN—		Round column—single spin-	Under	
OO—				
PP—		Spec. Kingsbury Way & Vertical	Up to 32" Swing	296
				250
			Swing	161

KEY letters are provided for your convenience in filling out the coupon to the right. They do not refer to any other listing of surplus property. If used in contacting War Assets Administration Regional Offices by letter, wire or phone, please refer to this advertisement.

EXPEDITING COUPON

Use this coupon to conserve your time. Circle by key letters the machines in the above group in which you are interested and mail to your nearest W. A. A. Regional Office.* We will determine in advance our stock situation on the machines and inform you quickly, without obligation.

To War Assets Administration:*
Do you have in surplus stocks the following circled machine tools? Where are they located? What is their condition?

A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, BB, CC, DD, EE, FF, GG, HH, II, JJ, KK, LL, MM, NN, OO, PP, QQ, RR, SS, TT, UU, VV, WW, XX, YY, ZZ.

I am also interested in the following machine tools not included in your list:.....

.....

.....

Name.....Tel. No.....

Firm.....

Address.....State.....

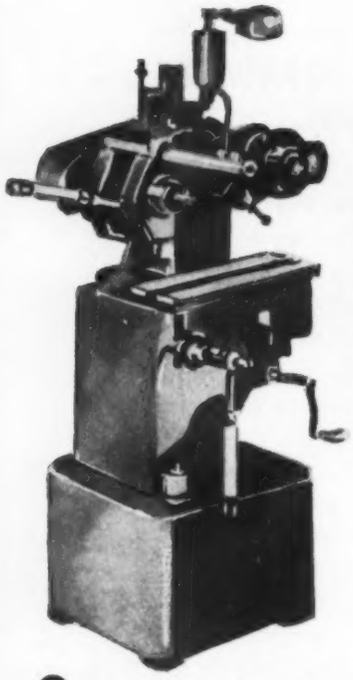
City.....

277-4

*For War Assets Administration address, see 4th page of this advertisement.

All items shown on this and preceding three pages are offered subject to prior sale. This surplus property has previously been advertised and offered to prior claimants including Veterans of World War II.

MILLERS



A Horizontal Hand-Feed Millers

For this and all the machine tools shown in this advertisement, simply contact your nearest War Assets Administration Office listed below, using the coupon provided. That office will know that large inventories of this miller, for example, are available in Boston, Detroit, Kansas City, and New York and how to get one or more for you.

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

These milling machines, and the other surplus machine tools shown on the preceding 3 pages, were productive enough and modern enough to win history's biggest war. They were versatile enough to turn out some of the most intricate weapons of all times. As they stand—some used and some unused—they are the largest untapped source of peacetime productivity and profits in the U. S. today. With them you can modernize and speed up your production or establish new enterprises at lowest cost. And it's easy to do. As a first step in acquiring these machines, simply fill in and mail the coupons on this or the preceding 3 pages.

B Horizontal Miller (knee type) *These machines are located in quantity as follows.* #1; under 28" Table Travel; New York, Boston, Detroit. #2; 28" to 34" Table Travel; Detroit, Cleveland, Boston. #3; 34" to 42" Table Travel; Detroit, Cleveland, Chicago and Philadelphia. #4; 42" to 50" Table Travel; Detroit, Cleveland. #5; over 50" Table Travel; Detroit, Cleveland, Chicago.

FREE INFORMATION

To War Assets Administration:

Without obligation, please send me detailed information on the milling machines checked at the right and on the following types not included in your list:

.....

.....

.....

277-4

MILLER CHECK LIST

(These key letters correspond to the machines listed in the table above. Simply check those in which you are interested.)

A E I
B F J
C G K
D H L

Name.....

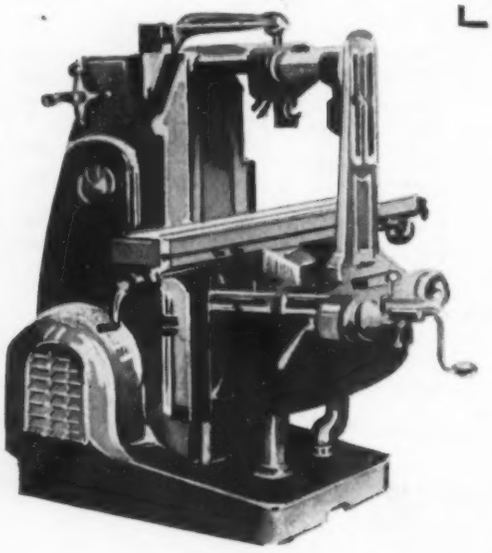
Tel. No.....

Firm.....

Address.....

City.....

State.....



SPECIAL MILLING MACHINE BUYS!

KEY	TYPE	SIZE OR CAPACITY	QUANTITY AVAILABLE NOW
A	Horizontal, Plain, Hand Feed	All sizes	564
B	Horizontal, Plain, Knee Type	#1 to #5	2,125
C	Vertical, Universal	#1 to #5	847
D	Auto Millers	All sizes	455
E	Bed Type, Plain, Horiz. Spindle	All sizes	2,703
F	Vertical Spindle, standard	All sizes	428
G	Vertical Fixed Bed Profiler	1 and 2 Spindles	847
H	Thread Millers—Universal (non-auto)	12" Work Dia. and up.	76
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K	Planetary Milling Machines	6" Work Dia. and up	206
L	Spline Millers		248

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—for bringing business needs or "opportunities" to the attention of men associated in executive, management, sales and responsible technical, engineering and operating capacities with the industries served by the following McGraw-Hill publications:

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Textile World
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Classified Advertising Division

McGRAW-HILL PUBLISHING CO., Inc.

330 West 42nd Street
New York 18, N. Y.

BUSINESS OPPORTUNITY
(Continued from page 298)

FOR SALE: Machine tool business building special production machinery. Excellent patented product now on the market and in use by most of the large automotive, domestic appliance, and agricultural implement manufacturers. Attractive proposition for machine tool company or tool plant having excess capacity. Line recently redesigned. Complete patterns, fixtures and tools. Can be bought at attractive price. BO-699, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

PATENT ATTORNEY

PATENTS COPYRIGHT, Booklet "General Information concerning inventions and patents" and "Fee Schedule" sent without obligation. Established 1915, Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W. Washington 5, D.C.

WANTED

ANYTHING within reason that is wanted in the field served by American Machinist can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

WANTED

COMPLETELY MACHINED
GREY IRON CASTINGS
TO OUR BLUEPRINTS
We will furnish patterns.

Also would like to sub-out special machine work.

CW-685, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED

WANTED

3 DIMENSIONAL PANTOGRAPH, Complete with attachments, etc. Must be in good condition. State condition and price.

JOSEPH DAVIS PLASTICS CO.
ARLINGTON, N. J.

PRESS WANTED

Geared, #21B—Bliss or similiar make, with adjustable stroke (if possible)

MANHATTAN SCREW COMPANY
91 EDISON PLACE, NEWARK 5, N. J.

WANTED

BROWN AND SHARPE AUTOMATIC SCREW MACHINES—Air Corps officer starting business upon release desires several 00 and 0 machines. Condition not important if prices are low enough to allow for complete rebuilding.

W-695, AMERICAN MACHINIST
330 WEST 42ND ST. NEW YORK 18, N. Y.

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BOX NUMBER

When answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

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SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-609, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
SALES ENGINEERS
New York Metropolitan Area

To represent highly specialized distributor on

H.S. and Carbide Cutting Tools Grinding Wheels, Machine Tool Attachments and Accessories, Light Machine Tools

Submit written application, which will be held confidential, giving age, education and experience. Must have previous sales or shop experience in this general field. Salary and commission.

SW-683, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

MANUFACTURERS REPRESENTATIVE
PHILADELPHIA & VICINITY

Active in this area for past 25 years possessing sales and executive ability invites correspondence with manufacturers of products salable to Machinery and Machine Tool Users. Organization should be high grade and progressive in product and management.

RA-682 American Machinist
330 West 42nd St. New York, N. Y.

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Our client, an established manufacturer, wants new products or new ideas that might be developed into new products.

Experienced in steel casting, welding and machining in any combination—large sizes, great precision.

Selling industrial and manufacturing markets.

Please write Dept. 23 Communications in confidence. We are fully compensated by our client.

Charles H. Welling & Co., Inc.
INDUSTRIAL CONSULTANTS
52 Vanderbilt Ave., New York 17, N. Y.
New Products — New Processes

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**Residual shrinkage less than 1%*

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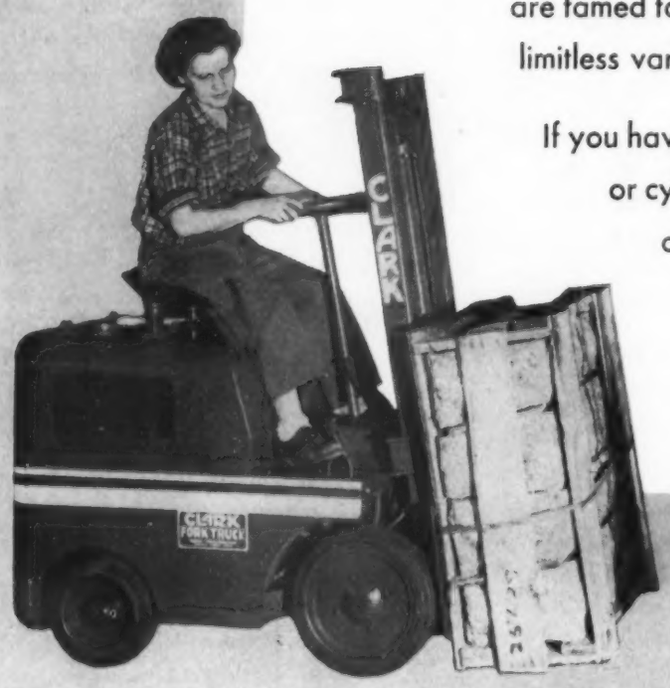
CLARK Materials-Handling Trucks

At the heart of the power plant in the Clark industrial Trucloader... famed for heavy-duty lifting and tiering ...you'll find a Gerotor hydraulic pump and a Gerotor hydraulic valve at work.

These Gerotor units, and many others like them, are famed for the job **they** do... in a virtually limitless variety of industrial applications.

If you have a difficult hydraulic pump, valve or cylinder problem, Gerotor engineers can give **you** a "big lift" too!



GEROTOR MAY CORPORATION Baltimore 3, Maryland

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CLECO GRINDERS

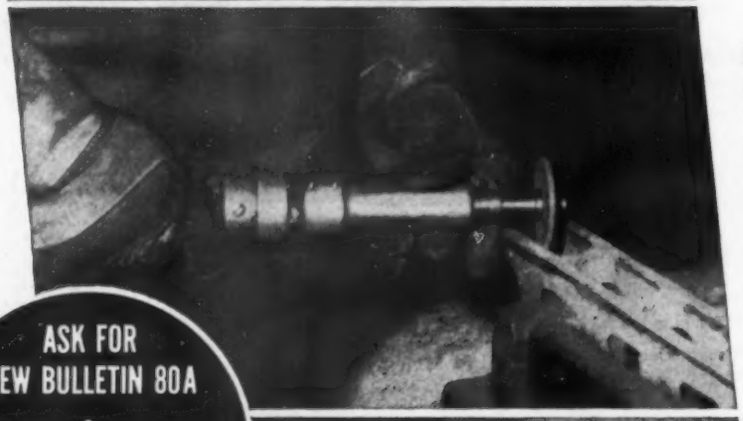
...the RIGHT model for EVERY job

HEAVY DUTY GRINDERS. Packed with power, yet easily held and vibration free. These tools start immediately even under load. The governor is set so that at 80-lb. pressure it holds the grinder safely at its most effective speed. Tool automatically shuts off if governor should break. Speeds from 3,000 to 9,000 R.P.M., straight or spade handles.

★

CONE GRINDERS. For grinding fillets and other curved surfaces of small radii. Also widely used to reach hard-to-get-at interior areas of dies, molds and castings. Ideal for auto body work and similar metal finishing. These tools are adaptations of our 490 and 460 Series (speeds of 5,800 to 9,000 R.P.M.) and our 214 Light Grinder Series (14,000 to 18,000 R.P.M.).

★



LIGHT GRINDERS. These small yet rugged pneumatic tools are splendid for finishing forgings, dies, metal patterns, castings and similar types of work. The 214 Series, governor controlled and including exhaust deflectors, operates at 14,000 to 18,000 R.P.M. The smaller No. 9 Series runs at 20,000 R.P.M. Weighing 1½ lbs. or less, this latter series uses ¾" mounted wheels.

★

VERTICAL GRINDERS. Used with abrasive wheels for surfacing steel sheets and bars, cleaning up welding operations, etc.; fitted with pad and abrasive discs they are used for auto body work, on metal furniture, etc.; also these vertical grinders can be fitted with cup wire brushes for removing rust, scale, paint, etc., from metal. Speeds from 4,300 to 8,000 R.P.M.

ASK FOR NEW BULLETIN 80A

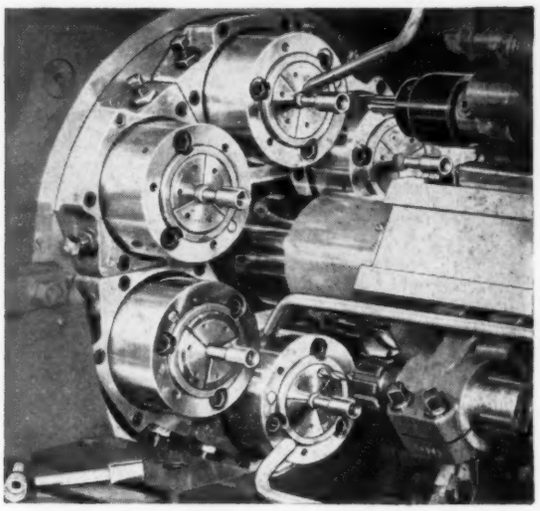
•

Replete with illustrations, it contains full data on over 35 sizes and types of Cleco Grinders, plus facts on air line accessories.

THE CLEVELAND PNEUMATIC TOOL CO. • 3781 EAST 77TH STREET CLEVELAND 5, OHIO

BRANCH OFFICES IN ALL PRINCIPAL CITIES

LEADERSHIP BASED ON ACCOMPLISHED FACTS

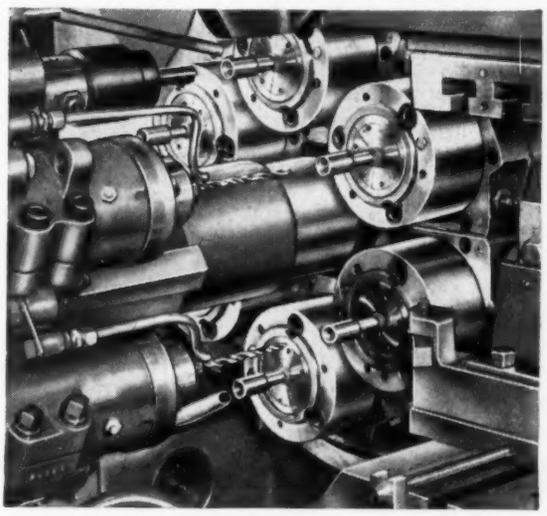


FRONT VIEW — New Britains are built to allow easy accessibility for simplified chucking, cutting tool and attachment setup.

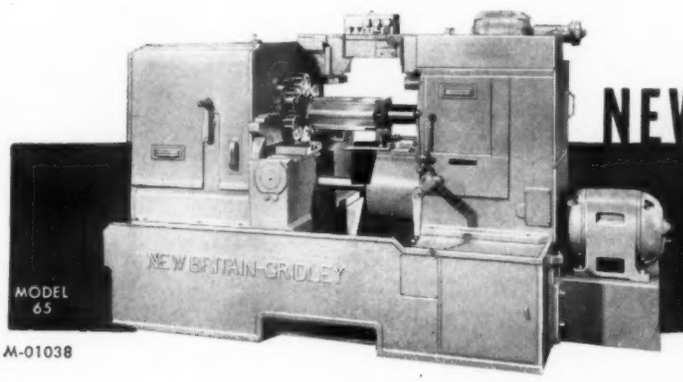
This will interest you if your work involves small accurate parts. In tooling and equipping our Model 65 Six Spindle Automatic Chucking Machines for the requirements of the Moeller Instrument Company, Richmond Hill, New York, provision was made for handling a variety of sizes of similar parts in various metals including steel, nickel copper alloy, and naval brass forgings.

The piece illustrated is a 3⅝" long tapered steel part, ¾" diameter on the large end, calling for drilling to a depth of 3½". It is held by specially designed collets, each with an extra long bearing, for drilling a deep hole leaving a thin wall. Six operations are performed at a gross production rate of 187 pieces per hour. Not a dramatically difficult assignment but a good illustration of the adaptability of New Britains to a wide range of applications . . . and another instance of high production at low cost per piece.

Many do not realize the wide range of practical applications for multiple spindle automatic screw and chucking machines. Our sales engineers *do*, and offer you a competent engineering service you may profit by investigating.



REAR VIEW — New Britain construction provides extra large chip space . . . lots of room from all sides giving excellent visibility and easy tool adjustment.



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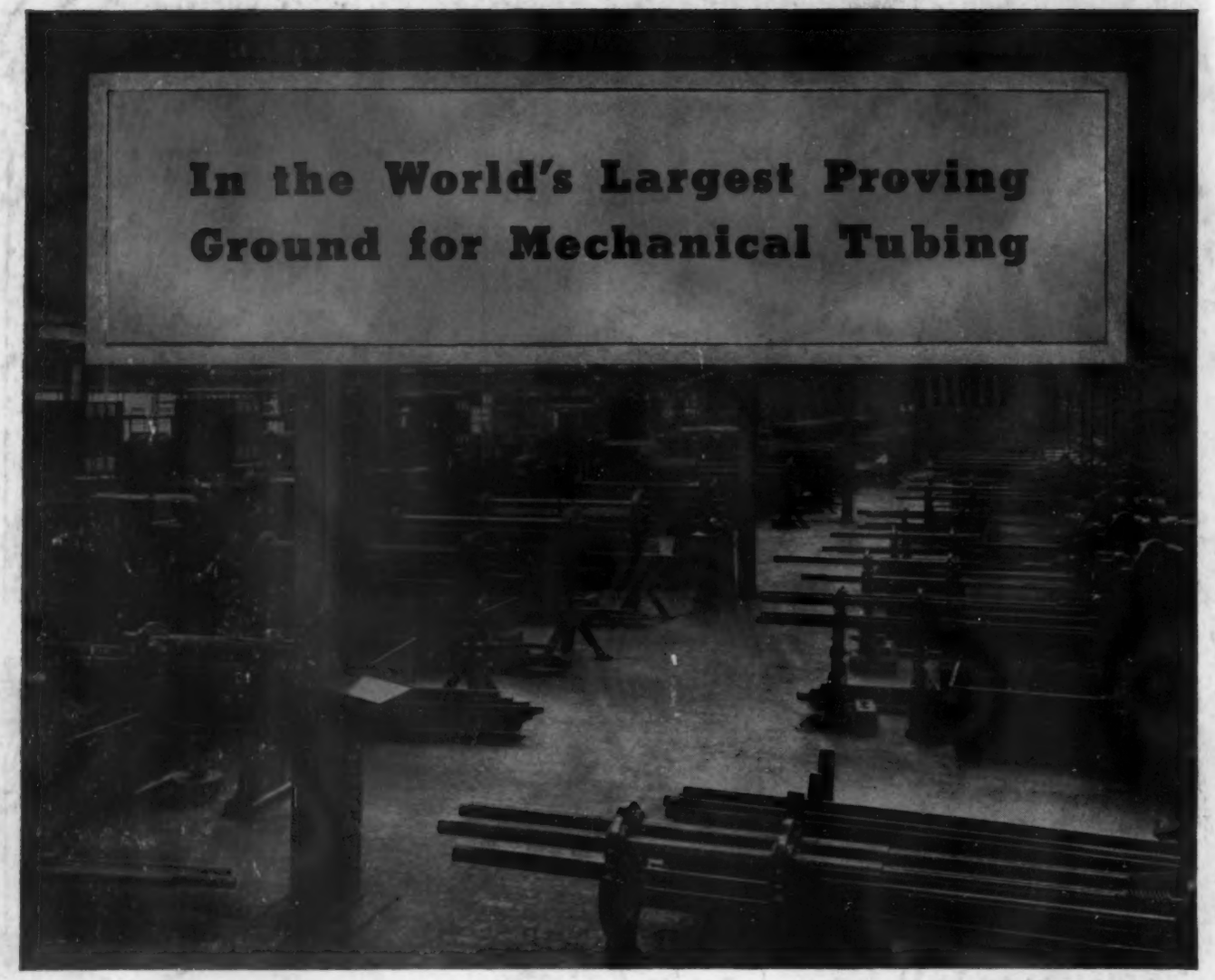
NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
New Britain-Gridley Machine Division



. . . we learned to tailor the tube to the job.
Pictured above is only part of the 600 screw machines in the huge plants of The Timken Roller Bearing Company.

Here, every year, millions of feet of Timken Alloy Steel Seamless Tubing with a wide variety of wall thicknesses is machined to form cones and cups for Timken Roller Bearings in sizes from 1¼ inch O.D. to 10 inch O.D.

From this great proving ground and from 30 years experience in supplying alloy steel seamless tubes to major users has developed unequalled experience in producing and selecting mechanical tubing exactly suited in grade, size and finish to meet your exacting requirements in the most economical manner.

Alloy steel seamless tubes very likely will improve your product or lower your cost. Our technical staff is eminently qualified to show you how. Let us send you a copy of our booklet "Timken Seamless Steel Tubes, Finishes and Sizes." Write Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

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Fine Alloy
STEEL AND SEAMLESS TUBES

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